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ATIKOKAN GS PREOPERATIONAL AQUATIC SURVEY YEAR I, 1981-1982

Report No 83-338-K

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ABSTRACT

The first of three years of aquatic biological studies to identify the base line environmental conditions of the cooling circuit at Atikokan GS was conducted during April 1981 to February 1982. Most physical-chemical and biological characteristics of the lakes in the cooling circuit were typical of lakes in northern Ontario with the exception of Moose Lake which demonstrated the effects of dewatering in some biological parameters. The substrate of the lakes generally consists of cobble-boulder-bedrock in shallow areas and organic sediments at deeper locations. The combination of thermal stratification and organic sediments results in hypolimnetic anoxia during the summer and winter. Macrophytes in the study lakes are typical of both soft water and hard water environments. *Elodea canadensis* which has been noted as a problem species in another cooling lake was present throughout the system. Phytoplankton and zooplankton composition and biomass was highly variable throughout the system while benthos varied between the upper lakes (Snow, Icy and Abie) and Marmion Lake. Fish catches also varied between Marmion Lake and the upper lakes with higher proportions of white sucker and lower proportions of cisco in the upper lakes. Walleye was present in all lakes of the cooling circuit except Snow Lake. Some walleye moved into Abie Lake to spawn. Hypolimnetic anoxia during the summer could severely limit the vertical distribution of coregonids.

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To Dr. C.D. Burnham
Design and Development Division

ATIKOKAN GS PREOPERATIONAL AQUATIC SURVEY
YEAR I, 1981-1982

G.T. Haymes

1.0 INTRODUCTION

Atikokan GS, currently under construction, will consist of one 200 MW lignite-fired unit. The condenser cooling water for Atikokan GS will be drawn from approximately the 10 m depth in Moose Lake and discharged on the surface into Snow Lake. The discharge water will circulate through Icy, Abie and Marmion Lakes before returning to Moose Lake (see Figure 2-1).

At new Ontario Hydro generating stations biological surveys are conducted prior to commissioning of the first unit. The purpose of these three years of study is to establish a baseline description of the physical-chemical and biotic features of the aquatic environment in sufficient detail to document significant changes in those features during similar studies conducted during the operation of the station.

The objective of the first year of pre-operational studies as requested by Environmental Studies and Assessments Department, Design and Development Division is to establish a baseline description of the aquatic environment in the area of the proposed Atikokan Thermal Generating Station. This description will include an assessment of the natural variation (spatial and seasonal) in the physical-chemical features as well as the flora and fauna of the major basins in the cooling water circuit.

2.0 STUDY AREA

The study area consists of the five lakes of the cooling circuit; Snow, Icy, Abie, Marmion and Moose, along with two control lakes, Lower Seine Bay, off Marmion Lake and Slush Lake. Fotheringham Lake had originally been chosen as one of the

83-338

control lakes, but was replaced by Slush Lake in mid July when it became apparent that the basin structure of Fotheringham Lake was quite different than those of the study lakes. Physical parameters at the study lakes are presented in Table 2-1.

Ten locations were chosen for study in 1981; one each in Snow, Icy, Abie, Slush and Moose Lakes, and Lower Seine Bay and four in Marmion Lake (Figure 2-1). Those being, one in the basin north of Anderson Dam, one at the outlet of Abie Lake, one at the West Dam, and the last in the central section of the lake.

Due to construction considerations the water level in Moose Lake had been lowered approximately 13 m, reducing the volume of water in the lake significantly and altering the shoreline drastically. This restricted access to the Lake until the end of June, 1981. Construction work later in the sampling season also resulted in the lowering of the water levels in Marmion, Abie, Icy, and Snow Lakes by approximately 1 m. The reductions in Marmion and Abie Lakes fell within recent water level fluctuation ranges. In February 1982, the breeching of a cofferdam between Snow and Icy Lakes caused a further drop of about 2 m in Snow Lake.

3.0 HISTORICAL PERSPECTIVE

Before the twentieth century the study area was part of the Seine River Valley, as it flowed from Lac des Mille Lac into Sawbill Lake, through Moose Lake, Steep Rock Lake and finally into Rainy Lake (Ontario Hydro Report No 75177).

In the late 1920's, the Minnesota Ontario Pulp and Paper Company built eight dams on the Seine River in the area of Moose Lake to provide head for a hydroelectric plant at Steep Rock Falls. With the discovery of iron ore under Steep Rock Lake and its subsequent exploitation by the Steep Rock and Caland iron mines, further work was completed that resulted in the diversion of the flow of the Seine River west, through Clearwater Lake (now Finlayson Lake) into the western arm of Steep Rock Lake. This resulted in the partial or total isolation of Marmion, Moose, and the central and eastern arms of Steep Rock Lake from the Seine River and the flooding of a large portion of land which is now part of Marmion Lake (see Section 5.1).

To allow work upon the ore body, the central and eastern arms of Steep Rock Lake were dewatered. The lake bottom sediments were then dredged off and deposited in the Upper and Lower Basins, of Moose Lake and the southern portion of Marmion Lake.

Direction of Water Flow

FIGURE 2-1

COOLING WATER CIRCUIT ATIKOKAN GS

158672-RD

TABLE 2-1

PHYSICAL CHARACTERISTICS OF THE STUDY LAKES
ATIKOKAN GS

	Lakes					
	Snow	Icy	Abie	Slush	Marmion	Moose*
Surface Area (ha)	41	101	94	28	10 516	60
Perimeter** (km)	3	9	8	3	455	8
Volume (m^3)	203×10^4	558×10^4	452×10^4	274×10^4	$71\ 385 \times 10^4$	786×10^4
Mean Depth (m)	5.0	5.5	4.8	9.7	6.8	13.2
Shoreline Development Factor**	1.4	2.5	2.3	1.6	12.5	2.8

* not drawndown
** excluding islands

By 1981, both mines had been closed for several years and the large pits were being allowed to refill naturally.

4.0 METHODOLOGY

A summary of the locations and schedule of sampling at Atikokan in 1981 is presented in Table 4-1. Sampling locations are on Figures 4-1 to 4-6. Locations were fixed using appropriate land marks. Complete descriptions of techniques follow.

4.1 Physical-Chemical Characteristics

4.1.1 Bathymetry

Bathymetric maps of the study area were compiled in 1981. Some of the lakes had been previously mapped by Ontario Hydro and the Ministry of Natural Resources. These findings were confirmed by soundings conducted during the summer. Bathymetries of lakes, not previously mapped were completed using a Furuno FE-400 recording echo sounder, and transposed from chart to contour map using the MNR proportional divider technique. Due to fluctuations in water levels of the lakes the maps were prepared with depth contours in meters above sea level, however, all other sampling was conducted at depths relative to the surface of the water.

4.1.2 Substrates

A map describing the distribution of substrate types in the study area was constructed based on visual observations of SCUBA divers on 58 transects supplemented by Ekman grab samples and casual observations during the course of the study.

Particle size determinations were made on the grab samples. Organic content of the samples was estimated as loss on ignition at 525°C after drying to constant weight at 105°C.

4.1.3 Temperature

Water temperatures were continuously monitored by Hydraulic Studies and Development Department from May through November in Icy Lake, Fotheringham Lake, and Lower Seine Bay. A Peabody-Ryan recording thermograph was placed on the bottom in Snow Lake. In addition, monthly vertical temperature profiles were taken at the maximum depth location at each of the ten sampling locations, using a Hydrolab series 4000 temperature recorder.

TABLE 4-1

SUMMARY OF SAMPLING - ATIKOKAN 1981

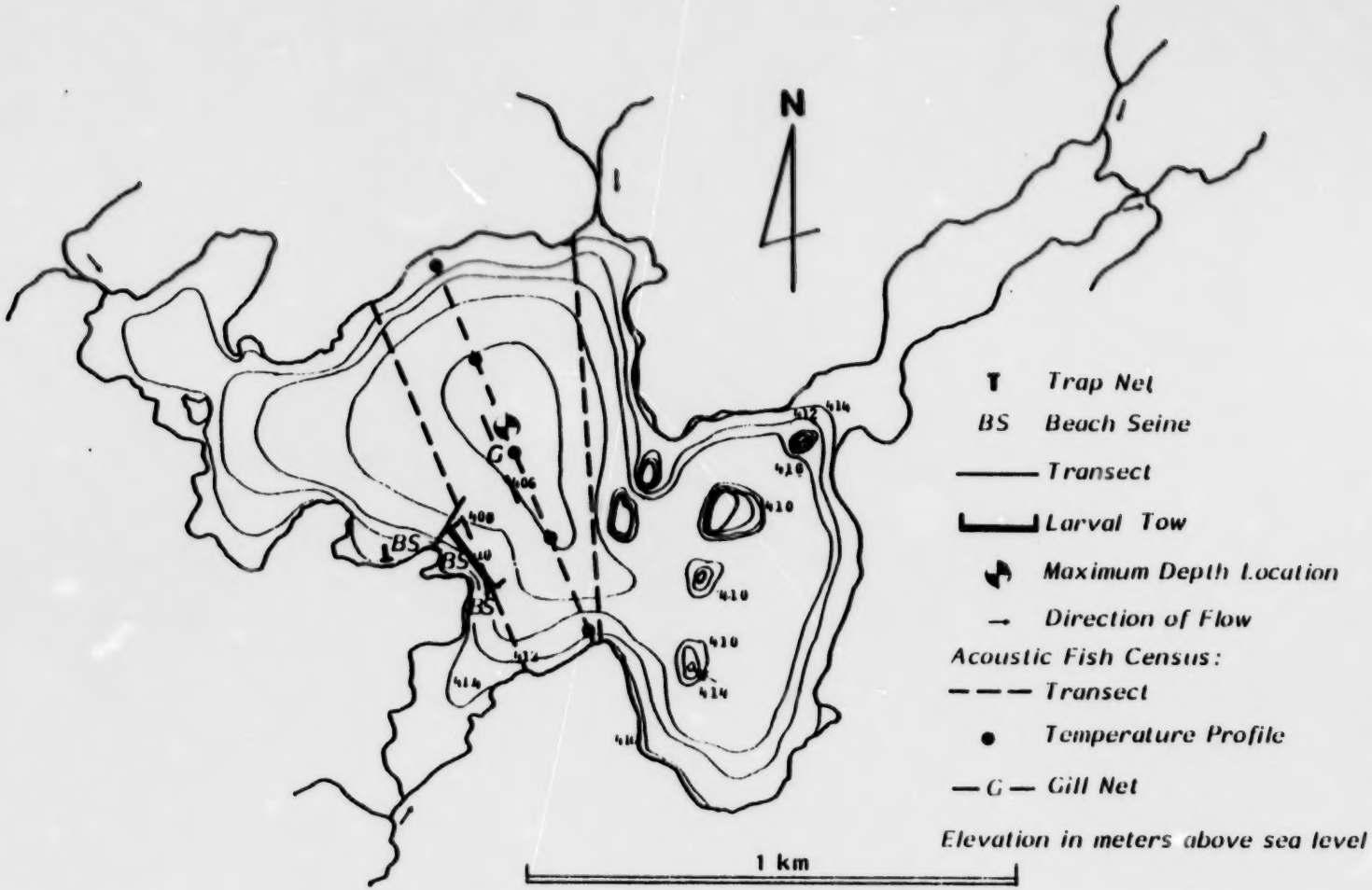
	May	Jun	Jul	Aug	Sep	Oct	Nov	Feb
Substrates				X				
Water Chemistry		X			X		X	X
Sediment Chemistry								X
Temperature Profiles		X	X	X	X	X	X	X
Dissolved Oxygen Profiles			X		X	X	X	X
Attached Algae	X			X		X		
Macrophytes: Biomass	X			X		X		
Map				X				
Phytoplankton		XX	X	X	X	X		X
Zooplankton		XX	X	X	X	X		X
Benthos				X		X		X
Fish: Larval Tows	XX	X	XX					
Beach Seines	XXX	X	X	X	X	X		
Trap Nets 1.2 m	XX	XX	X	X	XX	XX		
Trap Nets 1.8 m						X	X	
Acoustic				X				

MAPS NOT FILMED

SNOW LAKE

FIGURE 4-2
SAMPLE LOCATIONS - SNOW LAKE 1981

158383 RD

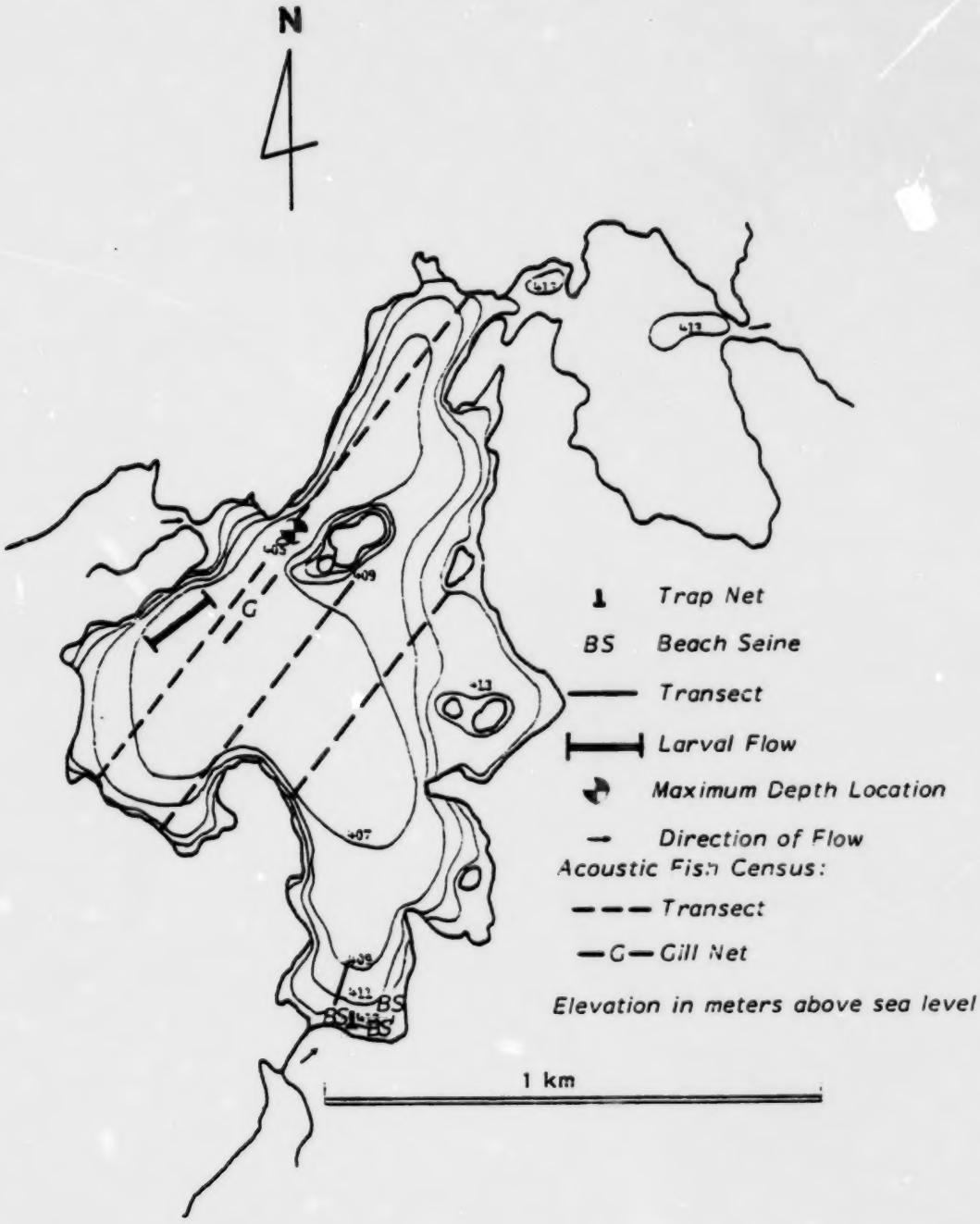


ICY LAKE

FIGURE 4-3

SAMPLE LOCATIONS - ICY LAKE 1981

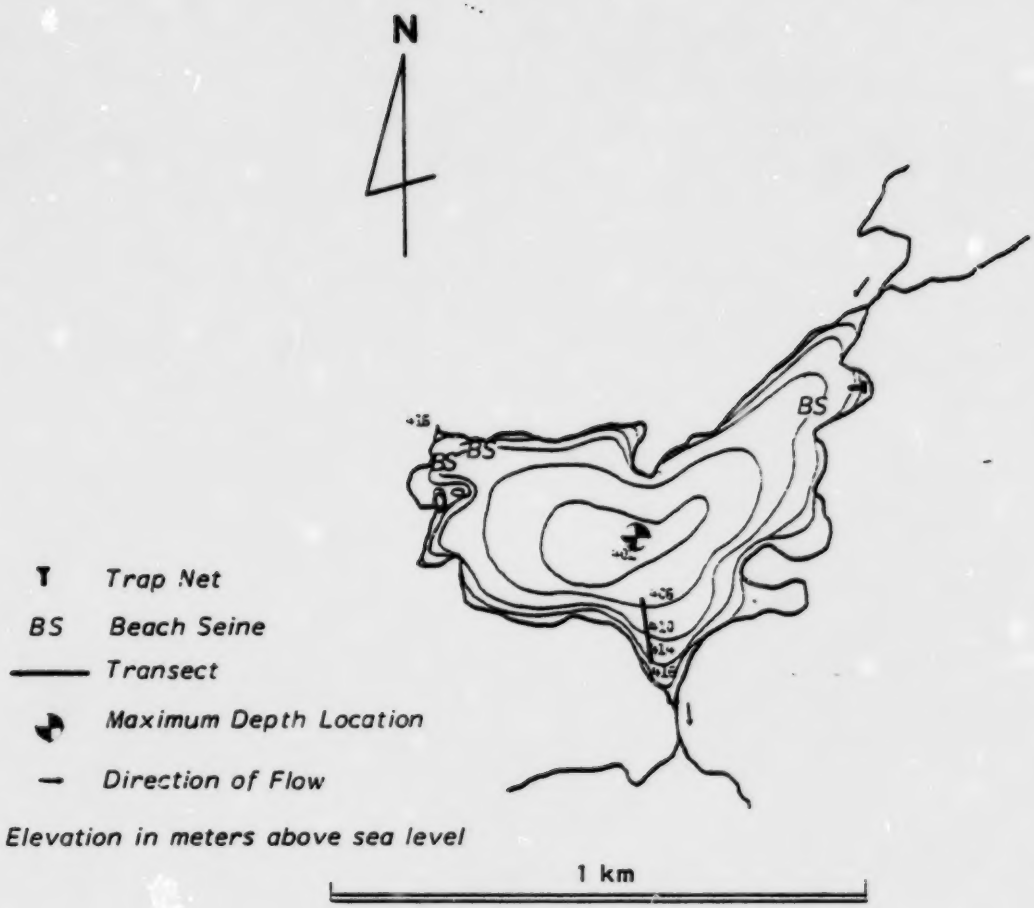
158384-RD



ABIE LAKE

FIGURE 4-4
SAMPLE LOCATIONS - ABIE LAKE 1981

158385 RD



SLUSH LAKE

FIGURE 4-5

SAMPLE LOCATIONS - SLUSH LAKE 1981

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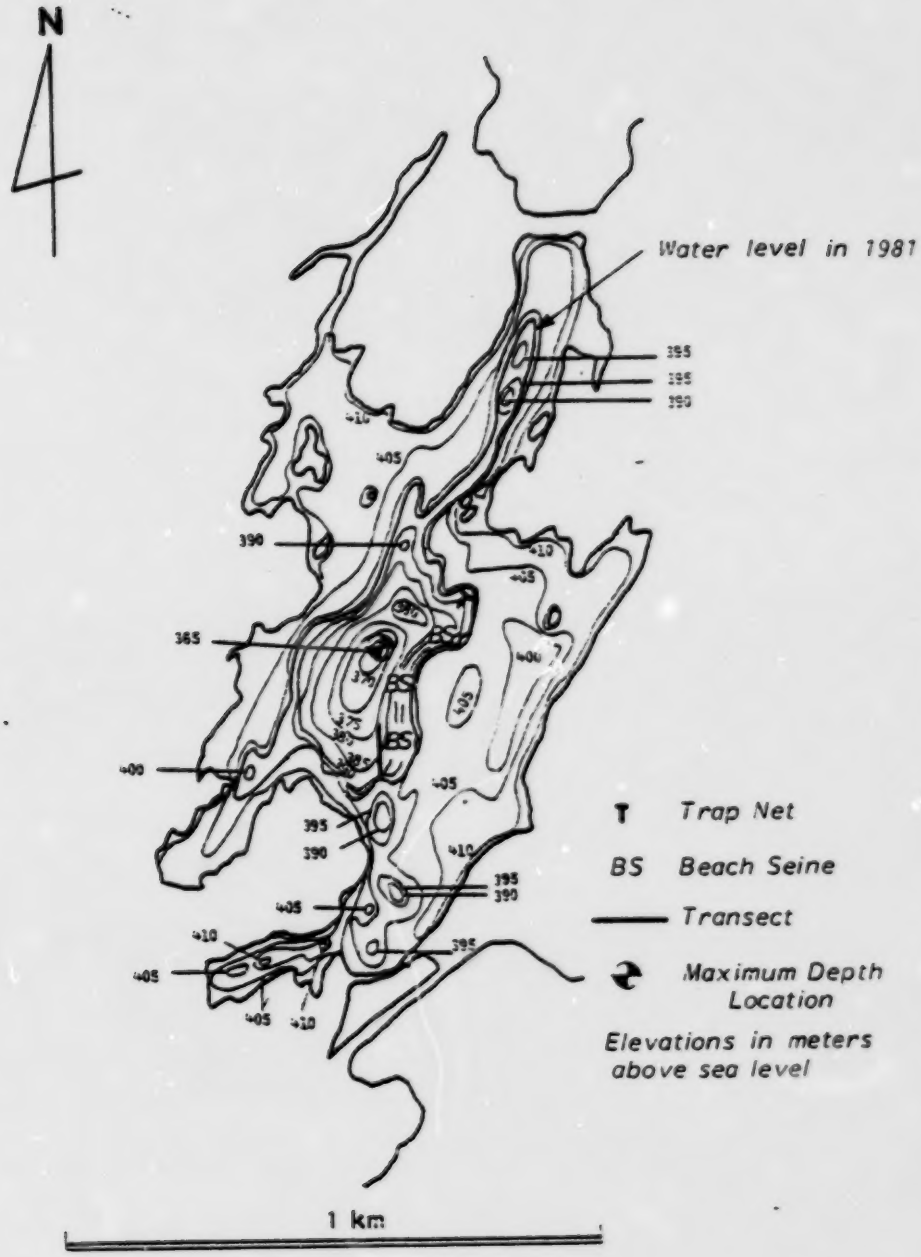


MOOSE LAKE

FIGURE 4-6

SAMPLE LOCATIONS - MOOSE LAKE 1982

158387 RD

4.1.4 Water Chemistry

Water quality samples were taken four times during the year, in May, August, November, and February at six locations, Icy Lake, Marmion Lake South, Marmion Lake North, Anderson Dam, Lower Seine Bay and Slush Lake. Samples were collected using an eight litre PVC Van Dorn sampler at 1 m below the surface and 1 m above bottom and preserved according to the guidelines in Ontario Hydro Research Division Report No 78-285-K.

The analyses were completed by the Analytical Services Section of the Ontario Hydro Research Division. A list of analyses, and analytic techniques can be found in Table 4-2.

In conjunction with the monthly temperature profiles dissolved oxygen profiles were also taken using a Hydrolab series 4000 meter. Secchi disc readings were also taken at this time.

4.1.5 Sediment Chemistry

Samples for sediment chemistries were collected in February by Ekman grab at the maximum depth location of each of the ten sample locations. Samples were preserved by freezing in linear polyethylene bottles and analyzed by the Analytical Services Section, Research Division for the parameters listed in Table 4-3.

4.1.6 Ice and Snow Cover

Break up was complete by late April when field crews arrived in Atikokan. Visual observations of ice depth and rate of formation were kept in October, November and February. Snow cover was also measured at all ten transect locations in February 1982.

4.2 Biological Characteristics

4.2.1 Attached Algae and Macrophytes

In July 1981 a survey of the shorelines of Snow, Icy, Slush, Abie, Marmion and Lower Seine Lakes was conducted to obtain baseline data on the aquatic vegetation in the cooling water circuit of the proposed Atikokan TGS and in control areas. Areas of dense macrophyte cover were located by boat and swum by two divers who noted the species present and visually assessed their percent cover. Voucher specimens of all species were collected and kept for future reference. Macrophytes were identified using the keys in Fassett (1975), Gleason (1968), Voss (1972), Riley (1979), Hellquist and Crow (1980) and Crow and

TABLE 4-2

WATER CHEMISTRY PARAMETERS

Parameter	Analytic Technique
Turbidity	Hach 2100 A Turbidimeter
Conductivity	Radiometer Conductivity Meter CPM3
pH	Fisher Accumet Meter
Gran Alkalinity	636 Metrohm Auto Titrator
Dissolved Solids Suspended Solids	Gravimetry
Nitrate	Dionex Model[12]
Total Phosphate Total Silica Ammonia Total Kjeldahl Nitrogen	Colorimetry
Total Organic Carbon Total Inorganic Carbon	Beckman 900 - TOC Analyser
Calcium Magnesium Sodium Potassium Iron Manganese Zinc Aluminum Hardness	Flame Atomic Absorption Spectrophotometry - Model IL751
Copper Nickel Mercury	Atomic Absorption Spectrophotometry Model IL951
Arsenic Selenium	Flameless Atomic Absorption Spectrophotometry

Hellquist (1981). Pondweed identifications were confirmed by G. Millar of the Ontario Ministry of the Environment. Charophytes were identified using Prescott (1951) and Prescott (1969).

TABLE 4-3

CHEMICAL PARAMETERS ANALYZED
IN SEDIMENT SAMPLES - ATIKOKAN 1981

Parameter	Analytic Technique
Total Organic Carbon	
Total Kjeldahl Nitrogen	Kjeldahl & electrometry
Phosphorus (PO_4)	Colorimetric
Potassium	AAS
Sulphide	Acidification, H_2S measurement
Magnesium	AAS
Manganese	AAS
Iron	AAS
Copper	AAS
Zinc	AAS
Aluminum	AAS
Nickel	AAS

AAS - Atomic Absorption Spectrophotometry

Biomass estimates of standing crop of macrophytes were made from triplicate samples at nine of the transects, during May, August and October, Moose Lake being omitted because of the effects of the lower water level. Samples were collected from three randomly selected plots using a 0.25 m x 0.25 m square at one metre and three metre depths at each of the sample locations. August samples from Marmion Lake South, Lower Seine Bay and Abie Lake were lost in transit before processing. All samples were frozen for storage. Biomass estimates were made by drying at 125°C.

Attached algal samples were taken concurrently with macrophytes, at all sample locations, including Moose Lake. Samples were taken in triplicate at the one and three metre depths from a 2.5 x 2.5 cm square and preserved in 10% formalin.

4.2.2 Phytoplankton

Phytoplankton samples were collected monthly from May to November, and in February, above the maximum depth location at each of the ten sampling locations. Samples were taken using a 3 m PVC tube and preserved with Lugol's solution. Species composition, and biomass were estimated for each sample.

4.2.3 Zooplankton

Zooplankton samples were taken concurrently with phytoplankton, using a 27 L Schindler-Patalas plankton trap equipped with 64μ mesh netting. Samples, consisting of duplicate hauls taken subsurface (0.5 m) and at 2 m intervals throughout the water column, were collected and mixed. Samples were preserved in alcohol and species composition and density estimates were made.

In February, samples were taken in triplicate using a Wisconsin net with a 64μ mesh netting by making vertical hauls from bottom to surface.

4.2.4 Zoobenthos

Samples were taken in August and October, and February at each of the ten sampling locations. In August, samples were taken along a transect at 1 m, 3 m, 5 m, 7 m and in the maximum depth location at each location. On soft substrates, samples were collected with a 6" x 6" Ekman grab; reduced by seiving through a #60 seive and preserved in 10% formalin. Where the substrate precluded the use of the Ekman, sampling was completed with a 6" diameter vacuum dome equipped with a slurp gun in October. Samples were taken in triplicate and preserved in 10% formalin.

In February triplicate samples were taken using the Ekman grab at 3 m, 7 m and the maximum depth location at each of the ten sampling locations.

4.2.5. Fish

A survey of traditional walleye spawning grounds was made on several evenings during early May. On each visit walleye were collected by beach seine or dip net, tagged and released. In addition SCUBA equipped divers surveyed a numer of shoals in Marmion Lake for evidence of walleye spawning (eggs, ripe adults). Larval fish were collected biweekly from May through June and once in July. Two, five minute surface tows were made parallel to shore at all sampling locations, excepting Moose Lake which was not accessible. In addition, tows were also conducted at the West Dam and the outlets of Icy and Abie Lakes, areas identified as walleye spawning areas. Tows were made using a set of two 0.5 m (diameter) conical nets with a mesh size of 363μ. Samples were preserved in 5% formalin.

Juvenile and forage fish were collected biweekly by beach seine in May and June, and monthly in July through October at all ten sampling locations. Hauls were in triplicate using a 50 foot beach seine and samples were preserved in 10% formalin.

Trap netting was conducted biweekly in May and June, monthly in July and August, and biweekly again in September and October. Single, 1.2 m trap nets were set along the shoreline at each of the ten sampling locations for two consecutive twenty-four hour sets.

In October and November, 1.8 m trap nets were set. Two consecutive twenty-four hour sets were made at each of the ten sampling locations and at several other locations where whitefish spawning/schooling was thought to be likely.

Because of construction activities in Moose Lake an opportunity to electroshock fish in a section of the lake confined behind a cofferdam was available in August. Repeated runs with the electroshocker allowed most of the larger fish in this area to be sampled.

With all sampling techniques, all adult walleye, northern pike and lake whitefish were sampled for length, weight and scales (for subsequent ageing). All live fish were individually tagged and released. On any mortalities, observations on sex, sexual status, and external injury, were kept.

In August, an acoustic fish census was conducted on Icy Lake, Abie Lake, Lower Seine Bay, and at two locations on Marmion Lake using the techniques outlined in Ontario Hydro Research Division Report No. C79-87-K. Subsequent 24 hour gill net sets at each location were used to verify the acoustic data.

5.0 RESULTS AND DISCUSSION

5.1 Physical-Chemical Characteristics

5.1.1 Substrates

The distribution of major substrate types was mapped based on visual observations and particle size determination of Ekman grab samples (Appendix 1). The maps (Figures 5-1 to 5-6) illustrate the substrate or combination of substrates that comprise at least 60% of the ground cover.

Generally the lakes in this system are characterized by a shoreline consisting of exposed bedrock or boulder and cobble. These rock substrates persist in the first few meters of water followed by a gradient of coarse sand and gravel to fine organic sediments with increasing depths. Important exceptions to this trend are the gravel beach in the area of Anderson Dam, the mining spoil areas east of Anderson Dam, the sand and gravel beach areas in the west basin of Abie Lake and to the south of the discharge in Snow Lake.

MAPS NOT FILMED

Combination of Substrates
Comprising >60% of the
Bottom Cover

Bedrock

Boulder - Cobble

Gravel - Pebble

Sand

Unconsolidated
Fine Sediments

40 SCUBA Transect

FIGURE 5-2

SNOW LAKE SUBSTRATES
(SUBSTRATES COMPRISE >60% OF THE BOTTOM COVER)

158468 RD

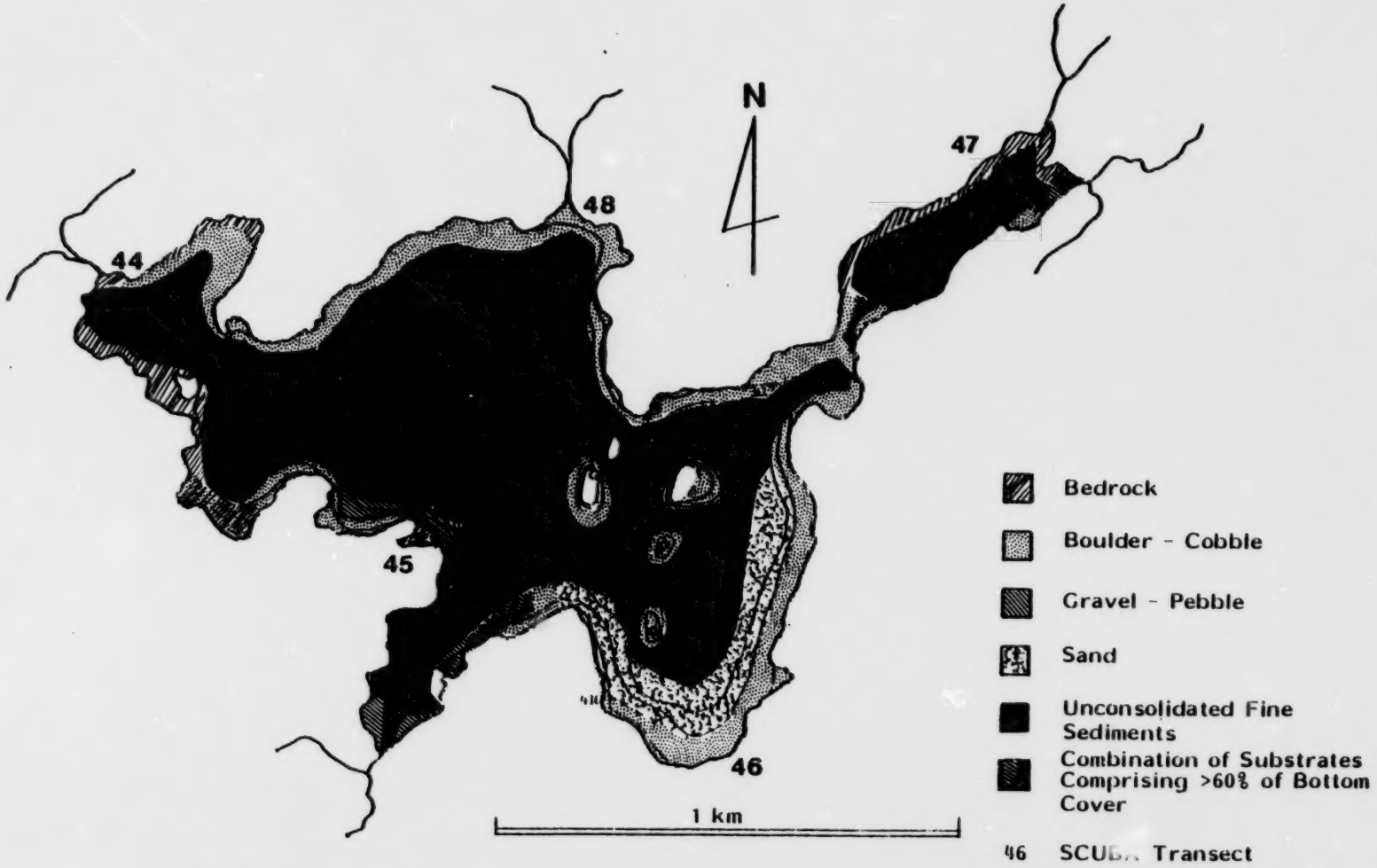


FIGURE 5-3

ICY LAKE SUBSTRATES
(SUBSTRATES COMPRISE >60% OF BOTTOM COVER)

158469 RD

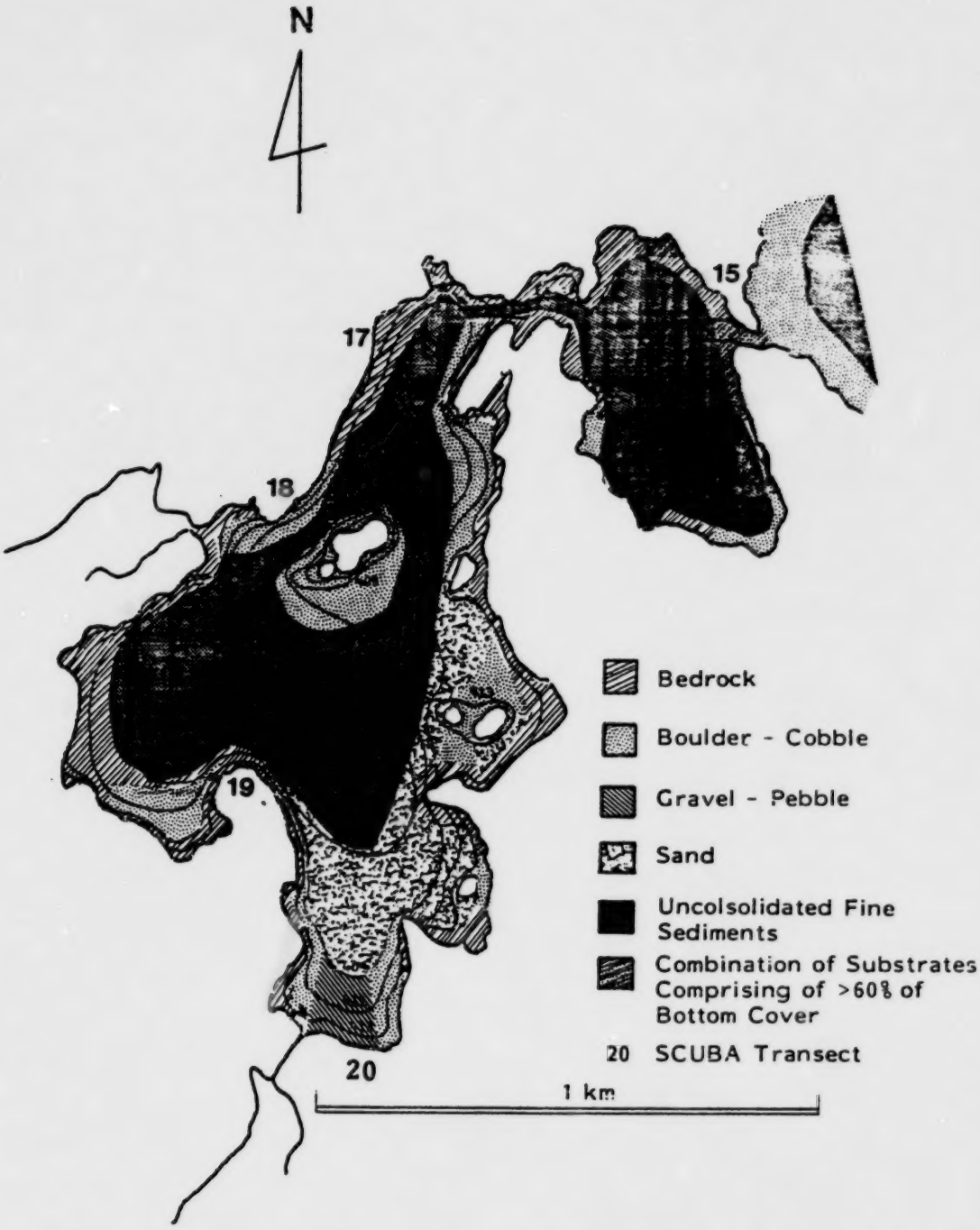
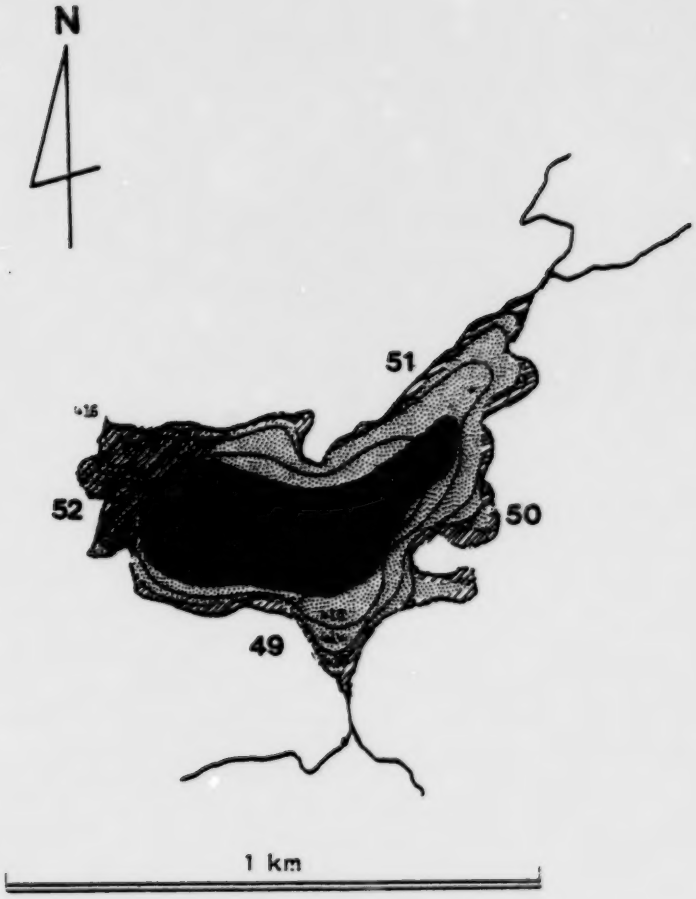


FIGURE 5-4

ABIE LAKE SUBSTRATES
(SUBSTRATES COMPRISE >60% OF BOTTOM COVER)



Bedrock

Boulder - Cobble

Unconsolidated Fine Sediments

Combination of Substrates Comprising >60% of Bottom Cover

49 SCUBA Transect

FIGURE 5-5

SLUSH LAKE SUBSTRATES
(SUBSTRATES COMPRISE >60% OF BOTTOM COVER)

158470 RD

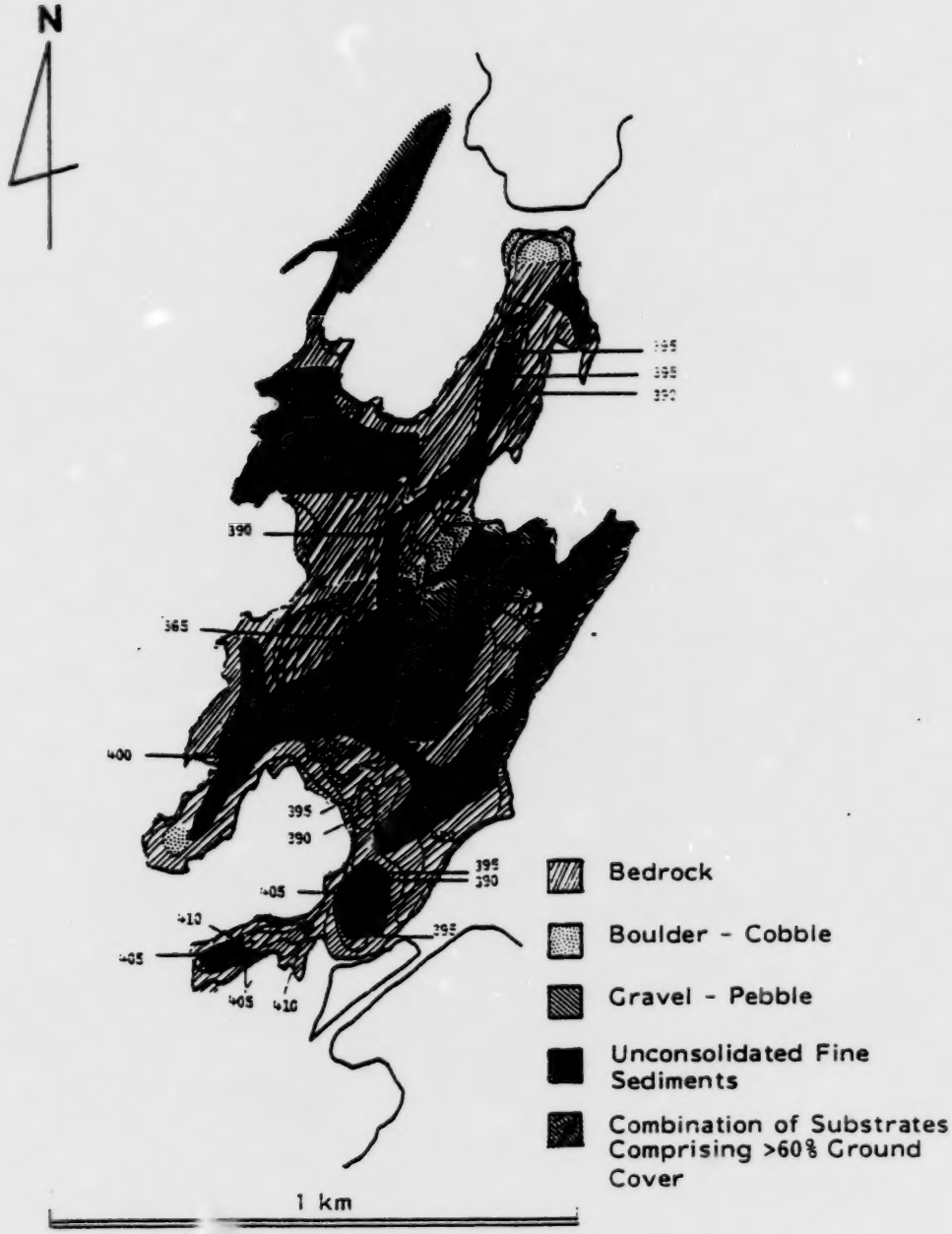


FIGURE 5-6

MOOSE LAKE SUBSTRATES
(SUBSTRATES COMPRISE >60 % OF BOTTOM COVER)

158471 RD

Organic content of sediment samples, estimated as loss on ignition at 525°C, are summarized in Table 5-1. As expected, the coarse shallow sediments were low in organics at all locations (range of means, 0.7 to 4.4%) while the deeper samples were substantially higher (20.3 to 47.2%).

TABLE 5-1

LOSS ON IGNITION (%)
OF SAMPLES - ATIKOKAN 1981

Location	Shallow		Deep	
	n	mean ± 1 SD	n	mean ± 1 SD
Anderson Dam	1	1.4	1	47.2
Mine Spoils	5	0.9±0.2		
Marmion Central	3	1.6±0.8	2	20.3±0.7
Marmion South	2	1.8±0.2	1	44.3
Lower Seine	3	2.1±0.7	2	39.2±30.0
Abie Lake	1	4.4	2	32.4±0.7
Icy Lake	1	0.7	5	29.1±27.6
Snow Lake	1	1.3	1	32.8
Slush Lake			1	35.6

As Marmion Lake is a reservoir, there are extensive treed areas which have been flooded. Some of the main locations where trees are near or above the water surface are on Figure 5-1. These were derived by air photo interpretation. The major treed areas are in the northern part of the lake. In addition to trees which are visible on air photos, trees which are below the surface of the water are also extensively distributed through Marmion Lake. Of the 39 transects sampled in Marmion Lake and Lower Seine 22 had trees along them. The transects with trees are circled on Figure 5-1. Based on the location of the historic shorelines on Marmion Lake the distribution of submerged stumps is presented in Figure 5-7 (derived from Dawson 1897).

5.1.2 Temperature, Dissolved Oxygen and Transparency

Continuous Temperature Monitoring

Results from continuous temperature monitors in Snow Lake, Fotheringham Lake, Marmion Lake and Lower Seine Lake are illustrated in Figures 5-8 to 5-9. In Marmion Lake, winter (February-March) temperatures at 1.6 m were relatively constant at 2-3°C before rising gradually through April, May and June.

FIGURE 5-7
ESTIMATED DISTRIBUTION OF SUBMERGED TREES AND STUMPS (SHADED AREA)
(AFTER DAWSON 1897)

160268 RD

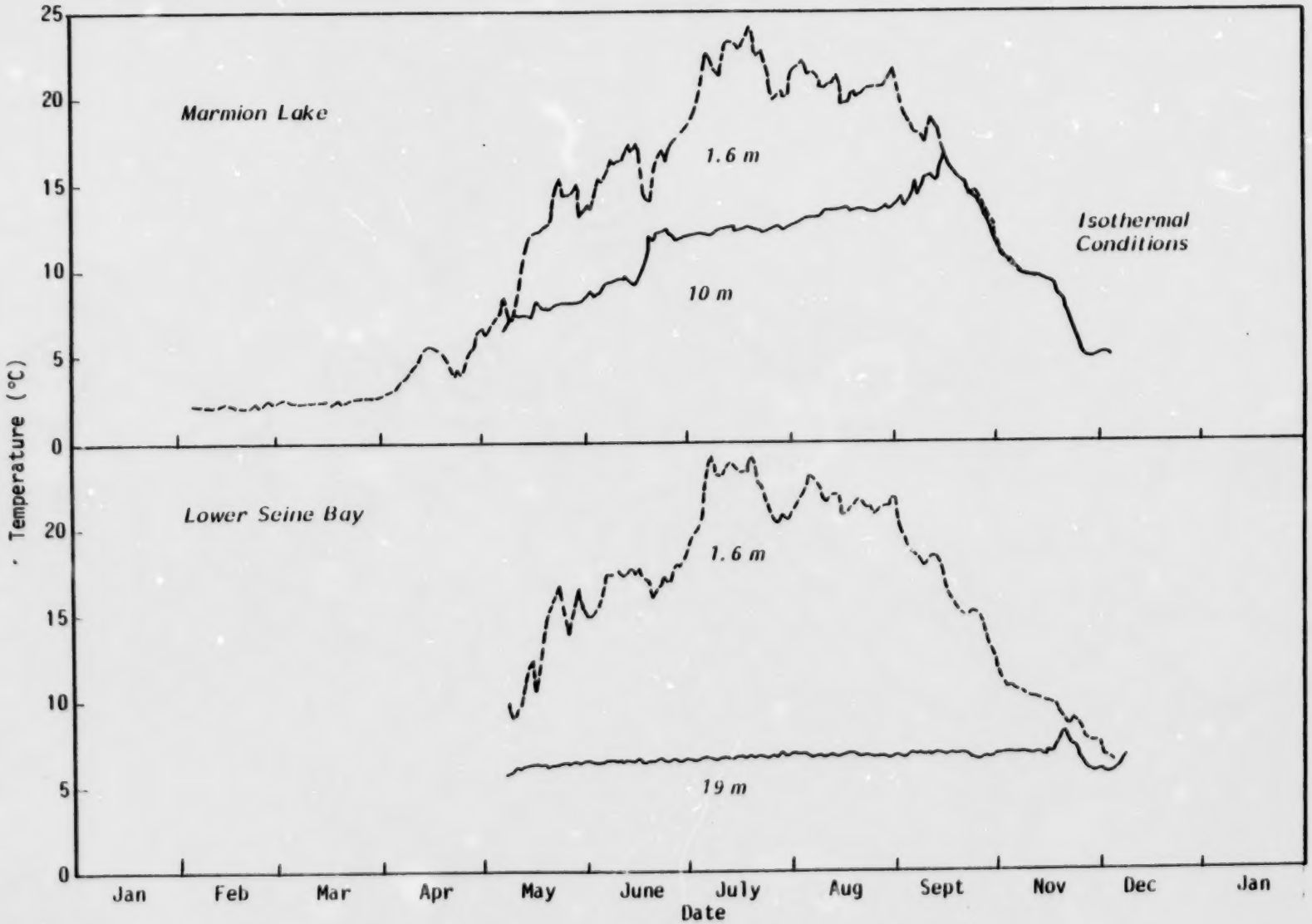


FIGURE 5-8

MEAN DAILY TEMPERATURE IN MARMION LAKE (1.6m AND 10m) AND LOWER SEINE BAY (1.6 AND 19 m) IN 1981

158388 RD

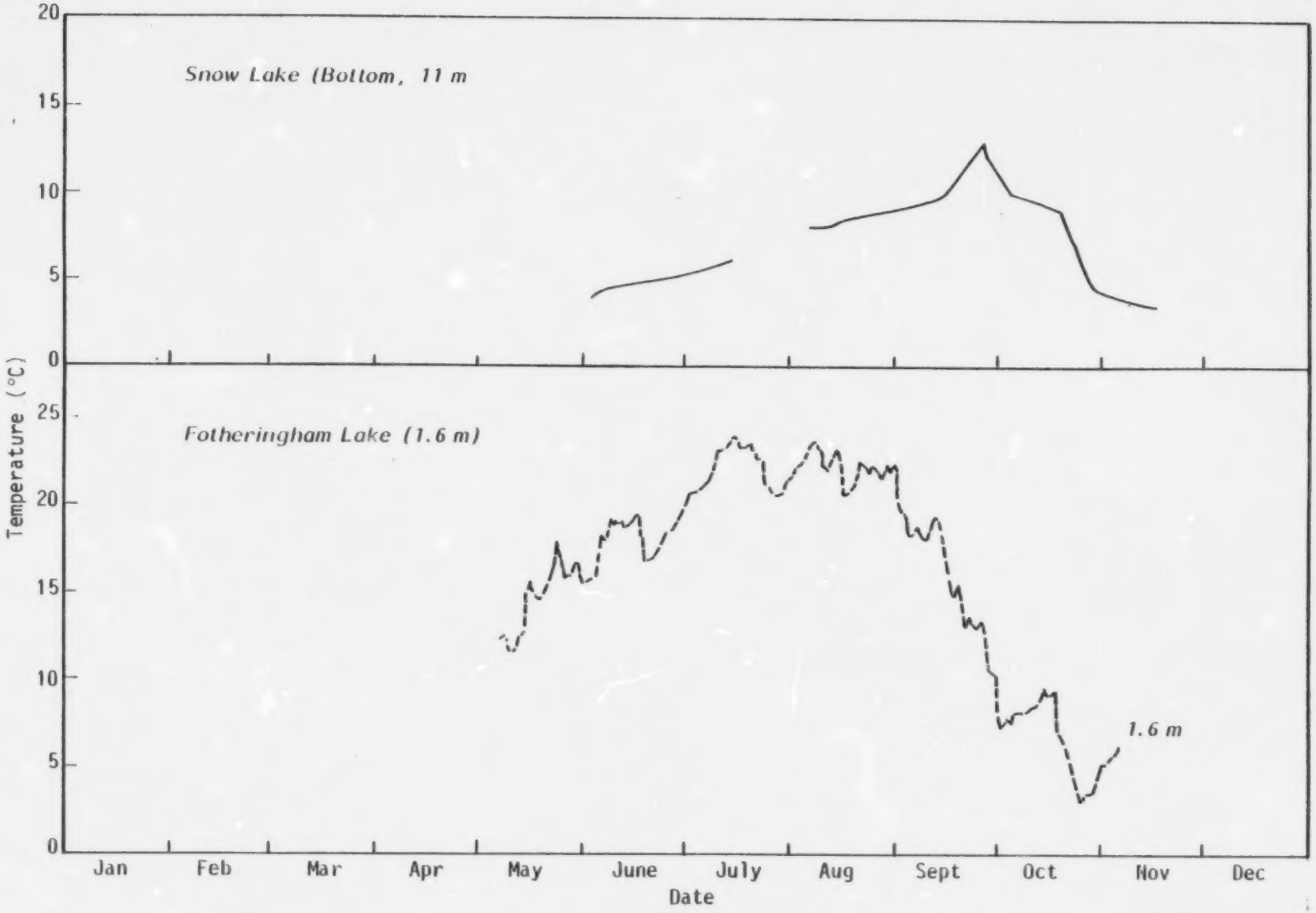


FIGURE 5-9
MEAN DAILY TEMPERATURES IN SNOW LAKE (BOTTOM)
AND FOTHERINGHAM LAKE (1.6 m) IN 1981

158389 RD

Peak temperatures of 20 to 24°C were reached during July and August followed by a gradual decline September through October. Temperatures at 1.6 m in Lower Seine Lake were similar to Marmion Lake with close synchrony of peaks and troughs. Temperatures in Fotheringham Lake (the only upper lake for which near surface water temperature data was available) at the same depth was similar in pattern to the larger basins but were generally 2 to 4°C warmer during May and June and 2 to 4°C cooler in September and October. Water temperatures in Marmion Lake at 10 m depth rose gradually May through August peaking at about 17°C in September. After peaking, temperatures at 10 m declined similarly to temperatures at 1.6 m depth. The near equal temperatures at 10 m and 1.6 m suggest isothermal conditions from mid-September through at least October. These conditions result in low stability and a high potential for mixing through at least the 10 m depth.

Temperatures at the bottom (approximately 11 m) of Snow Lake followed a similar pattern to that of Marmion Lake rising through the summer to a peak of 13°C in September.

At 19 m in Lower Seine Lake water temperatures were relatively constant ranging from 6-8°C through the May through October period. Near isothermal conditions (ie, equal temperatures at 19 and 1.6 m depths) occurred in late October.

Temperature Profiles

Temperature profiles are in Appendix 2 and summarized in Figures 5-10 to 5-12. Isothermal conditions were present in all basins in November suggesting a potential for mixing at that time which was verified by increased oxygen levels near the bottom.

Thermoclines formed in all basins during the summer although on some sampling dates there was no obvious thermocline but rather a gradual decline in temperature with depth. During June, July and August the depth of the thermocline in the basins ranged from 4 to 8 m while in September depths ranged from 6-9 m and from 12-13 m in October in the two basins where a thermocline was detectable (Table 5-2). On average the thermocline was approximately 1 m shallower in the upper lakes than in Marmion Lake.

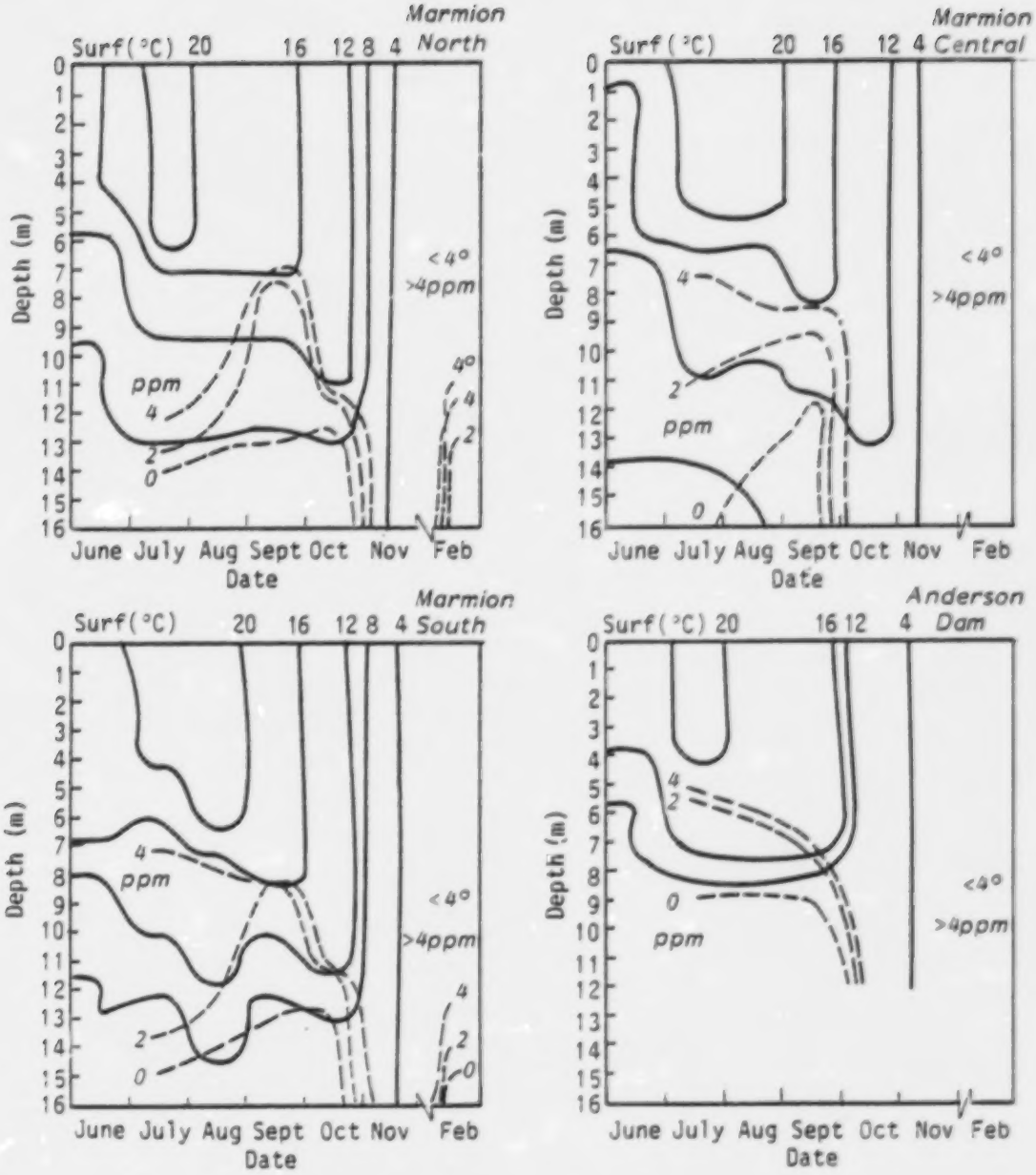


FIGURE 5-10

TEMPERATURE (SOLID LINES) AND DISSOLVED OXYGEN (DASHED LINES) PROFILES MARMION LAKE JUNE 1981 - FEB 1982

158390-RD

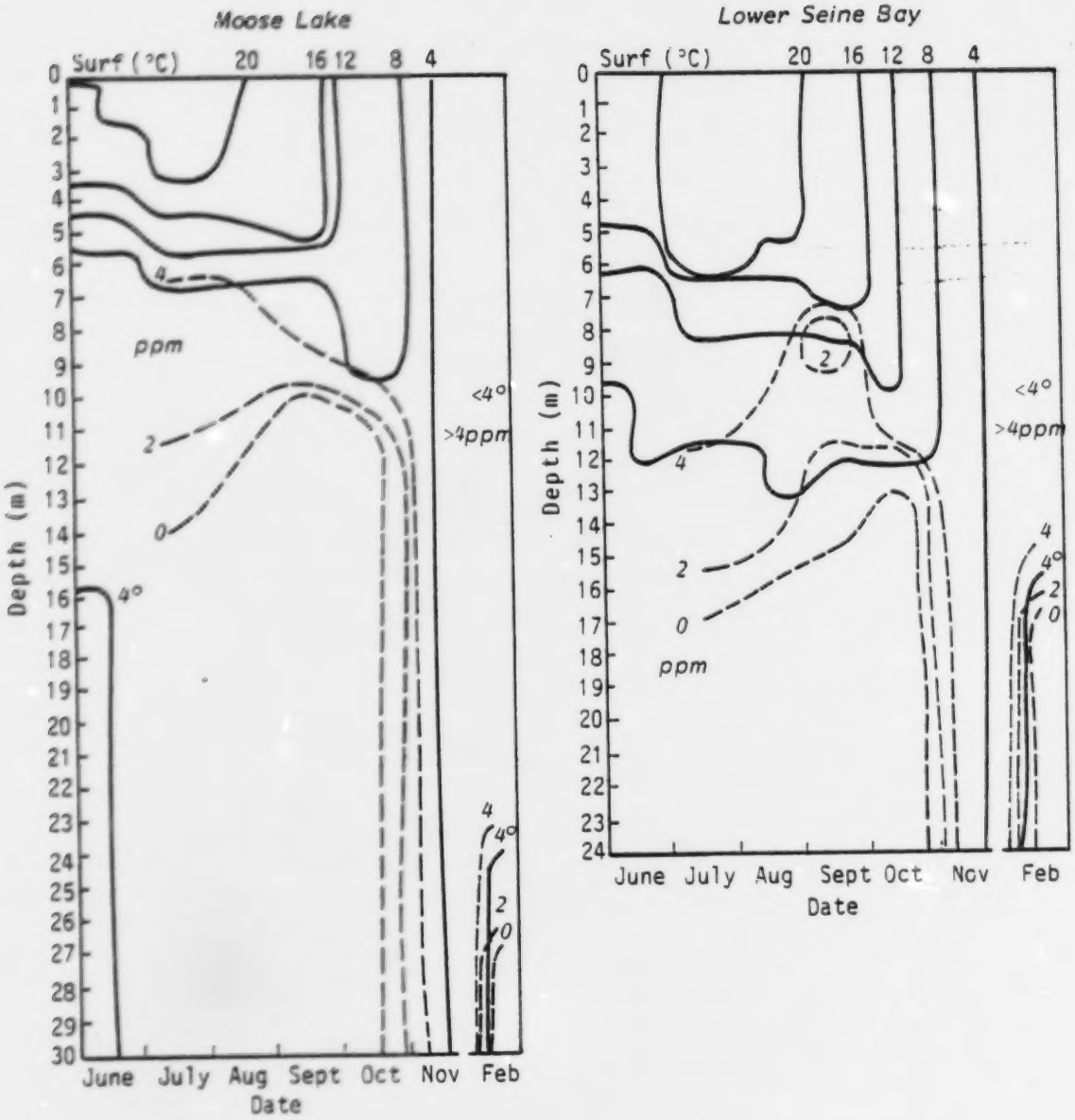


FIGURE 5-11

TEMPERATURE (SOLID LINES) AND DISSOLVED OXYGEN (DASHED LINES) PROFILES MOOSE LAKE AND LOWER SEINE BAY - JUNE 1981 - FEB 1982

158391-RD

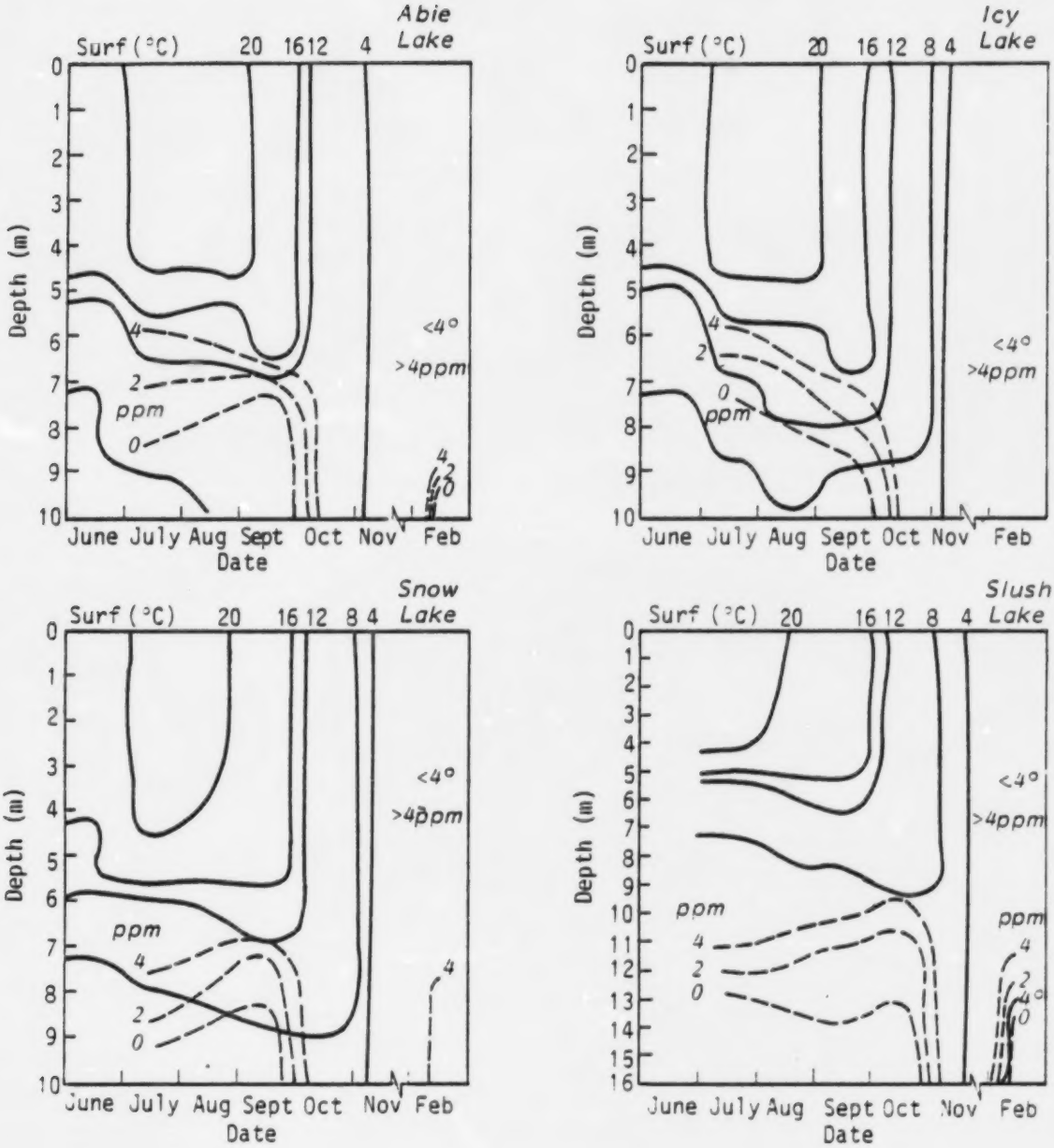


FIGURE 5-12

TEMPERATURE (SOLID LINES) AND DISSOLVED OXYGEN (DASHED LINES) PROFILES IN ABIE, ICY, SNOW AND SLUSH LAKES JUNE 1981 TO FEB 1982

TABLE 5-2

DEPTH OF THERMOCLINE[1] ATIKOKAN 1981
(m)

Location	Month				
	June	July	August	Sept	Oct
Snow Lake	6	6	-	7	*
Icy Lake	5	6	6	7	*
Abie Lake	5	6	5	7	*
Slush Lake	-	6	-	6	*
Marmion South	8	6	7	9	13
Marmion Central	7	*	7	*	*
Marmion North	*	7	-	*	*
Anderson Dam	5	*	-	8	*
Lower Seine	6	7	7	8	12
Moose Lake	4	6	-	6	*

1 Thermocline defined as the depth at which the largest drop in temperature occurred (minimum of 3°C)
- no data
* no obvious thermocline

Dissolved Oxygen Profiles

Dissolved oxygen profiles are listed in Appendix 2 and areas of low oxygen concentration are illustrated on Figures 5-10 to 5-12. All basins had zero oxygen concentrations at some time from July to September. The shallowest depths at which zero oxygen concentration was recorded ranged from 12-13 m in Marmion Lake with the exception of Anderson Dam which was 9 m and from 7 to 8 m in the relatively shallow upper lakes (Snow, Icy and Abie Lakes). The depths in Moose and Slush Lakes were 10 and 13 m respectively. This oxygen depletion is the result of a stable thermocline and high organic content of profundal substrates.

The relatively high (9 to 12 ppm) oxygen concentration in all basins in November indicate that mixing took place when isothermal conditions were present. However, by February low concentrations (<4 ppm), indicative of low mixing and high oxygen demand, were again recorded at all locations except Marmion Central, Anderson Dam and Icy Lake.

Transparency

Secchi depths are listed in Table 5-3. Although some data are missing, the mean Secchi depths at all locations were similar ranging from 3.1 to 3.7 m with the exception of Anderson Dam which was 2.3 m. The lower transparency at Anderson Dam is indicative of its turbid appearance on aerial photographs and possibly related to resuspension of fine sediments. On average Secchi depths were lower in October and November (2.5 to 2.7 m) than during the other sampling months (3.3 to 4.3 m) as might be expected with the apparent mixing which occurred during this period and higher plankton biomass identified in this study (Section 5.2.2 and 5.2.3).

5.1.3 Water Chemistry

Surface and bottom water chemistry data collected between June 1981 and February 1982 in Icy Lake, Marmion Lake South, Marmion Lake North, Lower Seine, Anderson Dam and Slush Lake are presented in Appendix 3. Mean levels in surface and bottom samples from each location as well as the ranges of the parameters monitored are presented in Tables 5-4 and 5-5, respectively.

Generally the lakes were found to be slightly acidic with low alkalinity, and contained moderate levels of nutrients and cations. With the exceptions of aluminum and manganese, heavy metal concentrations were close to or below their detection levels. Suspended iron levels were relatively high indicative of the history of iron mining in the area.

The lakes included in our study had higher levels of nutrients and cations than the lakes of the experimental lakes area (ELA) of northwestern Ontario examined by Armstrong and Schindler (1971) in 1968-1969. Nutrient levels in Icy, Marmion and Lower Seine Lakes were generally higher in 1981, than in 1975-1976 (Acres 1976). Chemical parameters were characteristic of shield lakes or lakes with partial shield drainage (Armstrong and Schindler 1971).

Comparison of Lakes

Based on a comparison of surface water chemistry (Table 5-4) three basins appeared to be slightly different from the others. Icy Lake on average had relatively high measures of specific conductance (13.3 mS/m), dissolved solids (91 mg/L at 105° and 66 mg/L at 550°), pH (6.7), gran alkalinity (60 mg/L $CaCO_3$), hardness (67 mg/L $CaCO_3$), calcium (20 mg/L), magnesium (4.0 mg/L), sodium (3.8 mg/L), total inorganic carbon (18.1 mg/L), chloride (4.3 mg/L), potassium (1.1 mg/L), total

TABLE 5-3

SECCHI DEPTH ATIKOKAN 1981

Location	Month							
	May	June	July	August	Sept	Oct	Nov	$\bar{x}$ ± 1SD
Snow Lake	2.8	3.8	-	4.4	4.0	2.1	3.1	3.4±0.9
Icy Lake	3.0	4.2	-	6.2	3.6	2.0	2.7	3.6±1.5
Abie Lake	-	4.1	-	4.6	3.8	2.0	2.8	3.6±1.0
Slush Lake	-	-	-	4.1	4.1	3.7	2.0	3.6±1.0
Marmion South	4.0	4.4	3.6	3.7	3.8	2.9	3.5	3.7±0.5
Marmion Central	3.3	4.0	3.6	4.1	3.0	2.0	3.0	3.3±0.7
Marmion North	-	3.6	4.7	4.0	2.8	3.2	2.8	3.5±0.7
Anderson Dam	3.0	3.2	2.7	3.7	1.2	1.2	1.4	2.3±1.1
Lower Seine	3.5	5.2	3.2	3.8	4.2	3.0	2.9	3.7±0.8
Moose Lake	-	-	-	4.0	3.2	2.9	2.3	3.1±0.7
$\bar{x}$ ± 1SD	3.3±0.4	4.1±0.6	3.6±0.7	4.3±0.7	3.4±0.9	2.5±0.8	2.7±0.6	

TABLE 5-4

MEAN LEVELS OF WATER QUALITY PARAMETERS IN SURFACE SAMPLES COLLECTED QUARTERLY IN
ICY LAKE, HAMILTON LAKE (SOUTH AND NORTH), ANDERSON DAM, SLOUGH LAKE AND LOWER SOUTH LAKE
ALTHOUGH AS PREOPERATIONAL STUDY YEAR 1

Parameter	Icy Lake Mean (Range)	Slough Lake[a] Mean (Range)	Hamilton South Mean (Range)	Lower Saline Mean (Range)	Hamilton North Mean (Range)	Anderson Dam Mean (Range)
Turbidity NTU	1.6 (1.1 - 1.8)	0.9 (0.6 - 1.2)	1.2 (0.6 - 1.9)	0.9 (0.5 - 1.2)	1.0 (0.6 - 1.7)	2.0 (0.6 - 3.5)
Secchi Depth m	1.6 (2.7 - 4.5)[b]	7.9 (5.0 - 11.1)	1.6 (1.5 - 1.8)[b]	1.7 (2.9 - 4.2)[b]	2.9 (2.8 - 3.0)[b]	1.8 (1.2 - 2.7)[b]
Conductivity mho/m	11.1 (12.1 - 16.7)		9.1 (8.7 - 10.2)	8.5 (7.8 - 9.1)	8.5 (6.8 - 10.0)	10.4 (9.2 - 12.0)
Suspended Solids (NVS) mg/l	<1 (<1 - <2)	ND	<1.7 (<1 - 2.4)	<1 (0.4 - <2.0)	<1.5 (<1 - 2)	<2.4 (<1 - 3.4)
(TVS) mg/l	<1 (<1 - <2)	ND	<1.4 (<1 - 1.2)	ND	<1.3 (0 - <2)	<1.7 (<1 - 2.8)
Dissolved Solids (NVS) mg/l	91 (70 - 102)	56 (10 - 87)	64 (59 - 72)	64 (58 - 74)	60 (56 - 67)	75 (70 - 80)
(TVS) mg/l	66 (60 - 84)	40 (10 - 58)	46 (30 - 68)	47 (30 - 70)	39 (30 - 52)	51 (45 - 56)
Calcium	None	None	None	None	None	None
pH	6.7 (6.4 - 7.7)	6.0 (5.6 - 6.5)	6.4 (6.1 - 7.2)	6.1 (5.8 - 7.4)	6.4 (6.0 - 7.1)	6.4 (6.0 - 7.5)
Dissolved Oxygen mg/l	11.0 (8.7 - 13.5)	11 (21 - 55)	11.6 (8.4 - 13.4)	11.4 (8.4 - 13.5)	11.5 (8.6 - 13.6)	11.6 (8.6 - 13.2)
Total Alkalinity ($CaCO_3$) mg/l	60 (54 - 63)	10 (22 - 58)	33 (30 - 36)	30 (28 - 31)	31 (28 - 36)	35 (33 - 38)
Hardness (EDTA) mg/l	67 (58 - 78)	12 (9 - 18)	42 (32 - 47)	40 (38 - 42)	40 (31 - 46)	56 (45 - 57)
Calcium mg/l	20 (18 - 24)	1.9 (1.0 - 3.6)	12 (10 - 13)	12 (11 - 13)	14 (12 - 15)	14 (12 - 15)
Magnesium mg/l	6.0 (3.1 - 4.7)	1.6 (0.6 - 3.0)	3.0 (2.9 - 3.4)	2.9 (2.7 - 3.0)	3.1 (3 - 4.4)	3.9 (3.5 - 4.4)
Sodium mg/l	3.8 (2.9 - 4.8)	2.9 (2.1 - 6.4)	2.0 (1.8 - 2.2)	1.7 (1.6 - 2.0)	2.9 (2.4 - 3.4)	2.2 (1.9 - 2.6)
Sulphate (SO_4) mg/l	5.3 (4.8 - 6.8)		9.5 (8.1 - 10.1)	6.5 (1.6 - 8.6)	8.6 (7.3 - 10.1)	12.1 (11.0 - 14.0)
Iron Suspended mg/l	0.055 (0.045 - 0.094)[a]	0.039 (0.010 - 0.074)	<0.022 (<0.005 - 0.044)	<0.011 (<0.05 - 0.05)	<0.044 (<0.05 - 0.057)	<0.008 (<0.05 - 0.165)
Dissolved mg/l	<0.055 (<0.05 - 0.06)	ND	ND	<0.071 (<0.05 - 0.14)	<0.05 (<0.05 - 0.05)	<0.075 (<0.05 - 0.11)
Nickel g/l	<0.19 (<0.15 - 0.2)	ND	ND	ND	ND	ND
Aluminum mg/l	<2 (<1 - 1)	ND	<2 (<1 - 4)	<0.18 (0.0 - <0.2)	<0.47 (<0.12 - 1.4)	<0.27 (<0.2 - 0.5)
Copper g/l	ND	ND	ND	<2 (<1 - 1)	3 (1 - 6)	<2 (<1 - 2)
Zinc mg/l	<0.05 (<0.02 - 0.07)	<0.02 (<0.02 - 0.01)	<0.01 (<0.02 - 0.06)	ND	ND	ND
Manganese mg/l	ND	ND	ND	<0.06 (<0.02 - 0.07)	<0.03 (0 - <0.05)	<0.06 (<0.02 - 0.12)
Mercury g/l	5.9 (5.3 - 6.2)[b]	8.0 (7.0 - 9.0)	7.2 (5.8 - 9.0)	ND	ND	<0.5 (<0.2 - 1)
Total Organic Carbon mg/l	18.1 (16.6 - 20.9)	5.1 (4.5 - 6.0)	9.0 (8.0 - 10.0)	6.2 (4.9 - 7.1)	8.4 (6.6 - 9.9)	6.8 (5.8 - 8.0)
Total Inorganic Carbon mg/l	4.1 (3.3 - 5.7)	1.5 (0.1 - 1.8)	1.9 (1.7 - 2.0)	8.6 (8 - 10.1)	7.6 (7.2 - 8.0)	9.6 (8.8 - 10.1)
Chloride mg/l	1.1 (0.9 - 1.2)	0.6 (0.4 - 0.8)	0.7 (0.6 - 0.8)	1.7 (1.7 - 1.8)	1.7 (1.5 - 2.0)	2.5 (1.9 - 4.0)
Fluoride mg/l	18 (8 - 18)	<2 (<5 - 10)	15 (9 - 19)	0.7 (0.6 - 0.7)	0.7 (0.6 - 0.8)	0.8 (0.7 - 0.9)
Total Phosphorus g/l	8 (5 - 10)	<4 (1 - 6)	10 (8 - 11)	11.8 (6 - 20)	15 (6 - 22)	20.5 (7 - 47)
Soluble Phosphorus g/l	11 (8 - 11)	<5 (1 - 9)	6 (1 - 10)	1.7 (1 - 18)	7.5 (4 - 11)	<9.8 (<5 - 17)
Particulate Phosphorus g/l	0.52 (0.45 - 0.60)[b]	0.42 (0.32 - 0.55)	0.44 (0.11 - 0.54)	6 (2 - 11)	7.5 (2 - 16)	13 (0 - 80)
Total Kjeldahl Nitrogen mg/l	0.66 (0.45 - 0.96)[b]	0.63 (0.30 - 0.55)	0.12 (0.26 - 0.50)	0.46 (0.16 - 0.59)	0.44 (0.32 - 0.68)	0.56 (0.36 - 0.91)
Soluble Nitrogen mg/l	0.05 (0.02 - 0.10)	0.01 (0.0 - 0.02)	0.07 (0.04 - 0.09)	0.42 (0.28 - 0.59)	0.42 (0.29 - 0.65)	0.50 (0.29 - 0.70)
Particulate Nitrogen mg/l	<0.21 (<0.01 - 0.51)	<0.11 (<0.2 - 0.10)	<0.09 (<0.01 - 0.14)	<0.04 (<0.01 - 0.08)	0.03 (0.0 - 0.06)	0.06 (0.02 - 0.11)
Nitrate (NO_3) mg/l	1.62 (1.95 - 5.5)	2.5 (1.9 - 3.1)	2.6 (1.8 - 3.1)	<0.11 (<0.01 - 0.50)	<0.12 (<0.01 - 0.20)	<0.06 (0 - <0.2)
Nitrite (NO_2) mg/l	2.69 (1.89 - 5.1)	1.6 (1.0 - 2.7)	1.9 (1.6 - 2.7)	2.4 (1.0 - 3.5)	3.1 (2.7 - 3.4)	4.0 (2.2 - 5.2)
Total Silica (SiO_2) mg/l	ND	<0.01 (<0.01 - 0.02)	<0.02 (<0.01 - 0.04)	1.7 (0.9 - 2.4)	2.3 (2.3 - 2.4)	2.6 (1.9 - 11)
Soluble Silica (SiO_2) mg/l				<0.02 (<0.01 - 0.03)	<0.01 (<0.01 - 0.10)	<0.01 (<0.01 - 0.02)
Ammonia (NH_3) mg/l						

(a) Not detected
(b) Some data missing
(c) Intensive data missing
(d) Secondary data missing

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TABLE 5-5

MEAN LEVELS OF WATER QUALITY PARAMETERS IN BOTTOM SAMPLES COLLECTED QUARTERLY IN ICY LAKE, MARMION LAKE (SOUTH AND NORTH), ANDERSON DAM, SLUSH LAKE AND LOWER SKING LAKE AFTERGRAM 65 PREOPERATIONAL STUDY YEAR 1

Parameters	Icy Lake	Slush Lake	Marmion South	Lower Sking	Marmion North	Anderson Dam
Turbidity - NTU	2.1 (1.2 - 4.3)	1.4 (0.8 - 1.8)	1.2 (1 - 1.6)	1.6 (0.8 - 1.8)	2.6 (0.5 - 5.4)	4.7 (1.0 - 10.0)
Conductivity - mho/m	14.1 (11.1 - 15.1)	7.8 (4.8 - 11.1)	9.3 (0.6 - 9.6)	8.7 (8.1 - 9.2)	7.4 (5.2 - 9)	10.7 (9.2 - 13.0)
Suspended Solids 105°C mg/L	<4.9 (<2 - 15)	<1.9 (<2 - 2)	<1.6 (<1 - 2.2)	<1.7 (<1 - 2.0)	<2 (<1 - 3.6)	<8.2 (<2 - 22)
550°C mg/L	<2 (<2 - 4)	<1.7 (<2 - 2)	<1.1 (0 - <2)	<1.5 (0 - <2.0)	<1.4 (<1 - 2.0)	<3.4 (<2 - 5.0)
Dissolved Solids 105°C mg/L	90 (80 - 102)	57 (30 - 88)	63 (50 - 70)	67 (60 - 72)	56 (48 - 67)	78 (66 - 90)
550°C mg/L	79 (70 - 92)	42 (10 - 63)	41 (10 - 56)	53 (40 - 70)	30 (16 - 42)	66 (56 - 86)
Color	Mono	Mono	Mono	Mono	Mono	Mono
pH	6.6 (6.2 - 7.2)	5.9 (5.5 - 6.9)	6.1 (5.9 - 6.6)	6.1 (5.7 - 6.6)	6.4 (5.8 - 6.6)	6.6 (6.1 - 6.9)
Dissolved Oxygen - mg/L	4.2 (0.0 - 10.7)	-	3.0 (0.0 - 8.9)	3.6 (0.0 - 8.5)	4.6 (0.0 - 10.5)	4.9 (0.0 - 10.9)
Gran Alkalinity (as $CaCO_3$) - mg/L	63 (57 - 67)	31 (18 - 56)	34 (32 - 35)	29 (27 - 31)	26 (20 - 31)	36 (31 - 41)
Hardness ($CaCO_3$) - mg/L	70 (67 - 73)	37 (27 - 50)	44 (42 - 46)	41 (39 - 45)	37 (31 - 42)	53 (48 - 64)
Calcium - mg/L	21 (20 - 22)	12 (9 - 18)	12 (12 - 13)	12 (11 - 13)	11 (9 - 12)	16 (13 - 17)
Magnesium - mg/L	6.3 (6.2 - 6.4)	3.9 (3.0 - 3.6)	3.2 (3.1 - 3.4)	2.9 (2.8 - 3.0)	2.6 (2.1 - 3.1)	4.3 (3.5 - 5.3)
Sodium - mg/L	3.9 (3.6 - 4.4)	1.4 (0.6 - 3.1)	2.0 (1.8 - 2.3)	1.5 (0.2 - 2.3)	1.6 (1.3 - 1.7)	2.4 (2.0 - 2.8)
Sulphate (SO_4) - mg/L	5.0 (4 - 5.7)	2.7 (2.1 - 3.8)	11 (8.3 - 13.7)	5.0 (0.2 - 9.8)	4.8 (4.6 - 8.6)	13.0 (11 - 18)
Iron Suspended - mg/L	0.224 (0.06) - 0.711)	0.045 (0.028 - 0.055)	<0.019 (<0.005 - 0.074)	0.042 (0.005 - 0.086)	0.088 (0.024 - 0.20)	0.111 (0.066 - 0.185)
Dissolved - mg/L	0.240 (0.05 - 0.63)	<0.06 (<0.05 - 0.08)	ND	<0.06 (<0.05 - 0.07)	0.30 (0.05 - 0.83)	<0.26 (<0.05 - 0.72)
Nickel - mg/L	ND	ND	ND	ND	ND	ND
Aluminum - mg/L	ND	<0.19 (<0.15 - 0.23)	<0.16 (<0.12 - 0.96)	<0.17 (0.5 - <0.2)	<0.41 (<0.15 - 0.91)	<0.64 (<0.2 - 1.2)
Copper - mg/L	<2 (<1 - 3)	3 (2 - 5)	2 (<1 - 3)	2 (1 - 2)	3 (1 - 5)	<2 (<1 - 3)
Zinc - mg/L	ND	ND	ND	ND	ND	ND
Manganese - mg/L	0.43 (0.01 - 1.31)	<0.27 (<0.02 - 0.03)	<0.20 (<0.02 - 2.55)	<0.20 (<0.02 - 0.55)	0.18 (0.02 - 0.55)	0.22 (0.03 - 0.59)
Mercury - mg/L	<0.3 (<0.2 - 0.4)	ND	ND	ND	ND	ND
Total Organic Carbon - mg/L	7.1 (5.6 - 9.2)	9.1 (6.0 - 14.0)	7.1 (6.1 - 8.0)	<0.5 (<0.2 - 1.0)	7.1 (5.5 - 8.0)	7.2 (5.2 - 9.0)
Total Inorganic Carbon - mg/L	15.2 (7.8 - 18.0)	5.2 (3.2 - 7.0)	8.6 (6.2 - 10.0)	6.5 (5.2 - 8)	7.8 (6.4 - 9.0)	6.9 (4.5 - 12.0)
Chloride - mg/L	4.8 (4.3 - 5.2)	1.5 (0.3 - 3.8)	2.0 (1.7 - 2.4)	10.2 (8 - 15.6)	<1.7 (<2 - 2.0)	2.5 (1.9 - 3.2)
Potassium - mg/L	1.2 (1.0 - 1.2)	0.6 (0.4 - 0.8)	0.7 (0.6 - 0.8)	<1.8 (0 - <2)	0.4 (0.3 - 0.7)	0.9 (0.7 - 1.0)
Total Phosphorus - g/L	35.3 (5 - 100)	14 (9 - 24)	18 (6 - 39)	6.7 (0.6 - 0.8)	14 (5 - 42)	21 (8 - 32)
Soluble Phosphorus - g/L	10.3 (5 - 18)	7 (2 - 16)	10 (6 - 22)	16 (10 - 28)	<8 (<5 - 22)	11 (<5 - 26)
Particulate Phosphorus - g/L	0.64 (0.02 - 0.91)	7 (6 - 8)	8 (0 - 17)	10 (4 - 22)	-	-
Total Kjeldahl Nitrogen - mg/L	0.30 (0.06 - 0.66)	0.48 (0.30 - 0.71)	0.17 (0.12 - 0.43)	6 (2 - 9)	0.45 (0.16 - 0.55)	0.43 (0.12 - 0.54)
Soluble Nitrogen - mg/L	0.06 (0.01 - 0.19)	0.45 (0.31 - 0.65)	0.11 (0.26 - 0.43)	0.19 (0.10 - 0.48)	0.41 (0.29 - 0.55)	0.16 (0.28 - 0.51)
Particulate Nitrogen - mg/L	0.18 (<0.2 - 1.05)	-	0.06 (0.0 - 0.06)	0.17 (0.11 - 0.48)	0.04 (0.0 - 0.08)	0.02 (0.01 - 0.15)
Nitrate (NO_3) - mg/L	ND	<0.24 (<0.2 - 0.48)	0.17 (0.02 - 0.72)	-	<0.47 (<0.6 - 1.0)	<0.29 (<0.02 - 0.48)
Nitrite (NO_2) - mg/L	6.5 (4.7 - 7.9)	ND	ND	0.17 (<0.2 - 0.75)	ND	ND
Total Nitrite (NO_2) - mg/L	4.6 (3.9 - 5.2)	2.8 (2.3 - 3.3)	4.0 (3.5 - 5.0)	ND	5.0 (3.5 - 6.8)	5.2 (4.2 - 6.3)
Soluble Nitrite (NO_2) - mg/L	0.02 (0.01 - 0.2)	2.1 (1.7 - 2.3)	3.0 (1.8 - 3.9)	4.1 (3.1 - 5.8)	3.4 (1.8 - 5.2)	1.4 (2.6 - 4.2)
Ammonia (NH_3) - mg/L		<0.02 (<0.01 - 0.01)	<0.01 (<0.01 - 0.02)	3.4 (1.9 - 5.0)	<0.02 (<0.01 - 0.05)	<0.06 (0.01 - 0.12)
				<0.02 (<0.01 - 0.03)		

ND - Not Detected
nl - Some data missing

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phosphorus (18μ g/L), particulate phosphorus (11 μg/L), total Kjeldahl nitrogen (0.52 mg/L), total silica (3.62 mg/L) and soluble silica (2.69 mg/L).

Anderson Dam was in some respects similar to Icy Lake with relatively high levels of nutrients but differed from Icy Lake in that levels of some metals were relatively high. Surface waters near Anderson Dam were relatively turbid (2.0 NTU) with relatively high measures of specific conductance (10.4 mS/m), sulphate (12.3 mg/L), suspended iron (maximum 0.165 mg/L), dissolved iron (maximum 0.11 mg/L), aluminum (maximum 0.53 mg/L), manganese (maximum 0.12 mg/L), mercury (maximum 1 μg/L), total phosphorus (20.5 μg/L), particulate phosphorus (13 μg/L), soluble nitrogen (0.50 mg/L), soluble silica (2.6 mg/L) and total silica (4.0 mg/L). The higher levels of some metals near Anderson Dam may be related to its proximity to the mine spoils deposited in Marmion Lake.

Unlike Anderson Dam and Icy Lake, Slush Lake tended to have relatively low levels of some nutrients and other parameters. Surface water samples from Slush Lake had the lowest determinations of pH (6.0), sulphate (2.9 mg/L), total inorganic carbon (5.3 mg/L), total phosphorus (<7 μg/L), soluble phosphorus (<4 μg/L) soluble nitrogen (0.45 mg/L), and particulate nitrogen (0.01 mg/L).

A similar separation is apparent upon analysis of bottom water samples (Table 5-5). Icy Lake bottom samples tended to have relatively high solids, alkalinity, pH and hardness and nutrients similar to surface water samples in the same lake. However, unlike surface samples, levels of some heavy metals, suspended and dissolved iron, manganese and mercury were also high relative to other locations. Parameters which were relatively high in surface samples at Anderson Dam tended to be relatively high in bottom samples, although nutrient levels were more similar to other sampling locations in bottom samples. Similarly parameters which were relatively low in surface samples from Slush Lake tended to be low in bottom samples.

Few temporal trends consistent in all lakes were obvious from the quarterly samples. Conductivity was highest in either November or February. The pH was lowest in September at all locations and ranged from 5.6 in Slush Lake to 6.4 in Icy Lake at the surface and 5.5 to 6.2, respectively, at the bottom. At the bottom, total phosphorous was highest in June in all lakes and at the surface it was highest in June at all locations except Marmion South and North. Except for Anderson Dam, surface total Kjeldahl nitrogen levels were highest in September. Surface levels of total silica were lowest in June, while bottom concentrations were highest in June. Low levels of total silica at the surface as well as high levels at the bottom were

probably a result of the spring diatom increase which would have depleted silica in the epilimnion before settling into the hypolimnion by June. This could not be confirmed since phytoplankton sampling was not initiated until June. Mercury was found in detectable levels or highest levels in September. Manganese levels were considerably higher in June at the bottom of the water column in all lakes. No consistent trends were obvious in the seasonal distribution of the remaining chemical parameters.

5.1.4 Sediment Chemistry

Surface sediment samples for chemical analysis were collected at or near the deepest points in Snow Lake, Slush Lake, Icy Lake, Abie Lake, Marmion South, Lower Seine, Marmion Central, Marmion North, Anderson Dam and Moose Lake. The sediment at these locations was composed of fine textured mud fitting the description for gyttja given by Reid (1961). Gyttja consists of a mixture of plant and animal remains, chemical precipitations and mineral substances.

The sediment constituents measured (Table 5-6) accounted for less than 25% of the dry weight of the sediment. The total organic carbon content of the sediment of the lakes was less than 15%. Gyttja typically has an organic carbon content of less than 50% (Reid, 1961). The total Kjeldahl nitrogen as well as phosphorus (PO_4) content of the sediment samples was less than 2%.

Loss on ignition (see Section 5.1.1) of profundal sediments from Atikokan were approximately six times higher than the measured total organic carbon. This is substantially higher than the 2.7 ratio reported by Brunskill et al (1971) for ELA lakes. In the latter study, however, total carbon was measured and assumed to be completely organic due to negligible levels of carbonate. The six fold difference between loss on ignition and total organic carbon in the Atikokan samples suggests the presence of unidentifiable oxidizable compounds other than typical organics of the form $C_6 H_{12} O_6$ which would result in a ratio of 2 to 3 rather than 1 to 6.

Of the sediment components measured, total organic carbon was the highest contributor to the dry weight of the sediment in Snow, Slush, Abie, Icy and Lower Seine Lakes. Iron made up the largest proportion of the sediment at all Marmion Lake locations (Marmion South, Marmion Central, Marmion North and Anderson Dam) and manganese was the main constituent in Moose Lake.

TABLE 5-6

LAKE SURFACE SEDIMENT CHEMISTRY
ATIKOKAN GS - YEAR I PREOPERATIONAL STUDY
FEBRUARY, 1982

Variables (g/kg)	Snow Lake	Slush Lake	Icy Lake	Abie Lake	Marmion South	Lower Seine	Marmion Central	Marmion North	Anderson Dam	Moose Lake
Total Organic Carbon	71	123	65	88	27	56	16	48	11	51
Total Kjeldahl nitrogen	13.0	17.0	8.8	14.4	3.8	7.3	1.2	10.8	1.3	7.0
Phosphorous (PO_4)	3.9	3.9	7.7	4.5	11.1	4.3	1.0	10.8	4.6	6.4
Potassium	2.0	1	4.7	2.7	5.7	4.3	6.0	4	6.5	2.0
Sulphide*	6.3	25.7	1.2	33.8	5.5	16.0	4.0	0.2	7.5	5.0
Magnesium	5.0	2.6	10	6.0	14	12.0	2.8	11	15	5.0
Manganese	0.7	2.1	0.7	0.8	12	6.4	3.0	4	1.7	91
Iron	22	25	28	32	48	44	43	78	44	22
Copper	0.07	0.09	0.14	0.08	0.1	0.07	0.10	0.11	0.06	0.07
Zinc	0.11	0.1	0.08	0.09	0.09	0.1	0.09	0.1	0.09	0.10
Aluminum	15	13	25	20	28	26	30	25	30	15
Nickel	0.02	0.02	0.03	0.02	0.04	0.03	0.05	0.03	0.05	0.02

* mg/kg

Compared to the surface sediment in the ELA lakes (Brunskill et al 1971) the surface sediments on our lakes on average contained lower proportions of total organic carbon and total Kjeldahl nitrogen but higher levels of phosphorous (Table 5-7).

TABLE 5-7

COMPARISON OF SURFACE SEDIMENT CHEMISTRY OF LAKES INCLUDED IN ATIKOKAN GS PREOPERATIONAL STUDY (FEBRUARY, 1982) WITH ELA LAKES (1969)

Study Lakes	Mean % Dry Weight (Range)		
	Total Organic Carbon	Total Kjeldahl Nitrogen	Phosphorus
Atikokan	5.6 (1.1 - 12.3)	0.9 (0.01 - 1.7)	0.6 (0.1 - 1.1)
ELA[1]	20 (8 - 34)	1.8 (0.77 - 2.7)	0.22 (0.23 - 0.33)

1 Total carbon was assumed to equal total organic carbon in the ELA lakes by Brunskill et al (1971) due to negligible levels of carbonate in the lakes.

Despite its use as a dump site for mine spoils (primarily overburden from Steep Rock Lake), the surface sediment in Marmion Lake was not found to contain substantially higher levels of heavy metals than other sampling locations although magnesium, iron, aluminum and nickel levels were found to be higher at Marmion Lake sampling locations than in the remaining lakes. The level of magnesium was highest at Anderson Dam, the iron level was highest at Marmion North, and aluminum and nickel levels were higher at Marmion Central and Anderson Dam.

5.1.5 Snow and Ice Cover

The ice had moved out of all the basins in the study area by the initiation of work on April 28, 1981.

Freeze up of some of the smaller bays and some small lakes in the area was observed by the second week of October. Ice in those areas was up to 4 cm thick. The ice in the bays persisted through to the end of sampling (November 12, 1981) when the main bodies of the lakes were still ice free.

In February depth of ice and snow were measured at all sampling locations. These are summarized in Table 5-8. Ice depth ranged from 18 cm in Snow Lake to 56 cm in Icy Lake ($\bar{x}$ = 43 ± 11 cm) and snow depth ranged from 19 cm at Marmion South to 58 cm in Snow Lake ($\bar{x}$ = 32 cm ± 8 cm). Slush at the interface of ice and snow was present in Abie, Slush, Moose and Lower Seine Lakes.

TABLE 5-8

DEPTH OF ICE AND SNOW, ATIKOKAN FEBRUARY 1982

Location	Ice Depth (cm)	Snow Depth (cm)	Comments
Snow Lake	18	58	No Slush
Icy Lake	56	20	
Abie Lake	38	28	Slush at Icy Outlet
Slush Lake	38	22	Slush (5 cm)
Marmion South	50	19	No Slush
Marmion Central	44	27	No Slush
Marmion North	48	31	No Slush
Anderson Dam	54	no record	No Slush
Lower Seine	48	30	Slush (23 cm)
Moose Lake	37	30	Slush West Side
$\bar{x}$ ± 1SD	43±11	32±8	

5.2 Biological Characteristics

5.2.1 Attached Algae

Species Composition

The attached and epiphytic algae from the five study lakes at Atikokan in 1981 were composed of twenty-one taxa belonging to three divisions: Chlorophyta (green), Cyanophyta (blue greens) and Chrysophyta (Bacillariophyceae - diatoms) (Table 5-9 to 5-11). Overall, blue greens were dominant on each sampling occasion. In May algae were found at five sampling locations and there was no clear pattern of species dominance with either site location or sample depth. In August samples collected at the 1 and 3 m depths in Marmion Lake North and Moose Lake, the 3 m depth in Marmion Lake South and the 1 m depth in Lower Seine contained no algae. *Calothrix* was the dominant genus at ten of the remaining sampling locations, *Lyngbya*, at two locations and *Phormidium* and *Anabaena* at one location each. The

TABLE 5-9

MEAN % COMPOSITION OF ATTACHED ALGAL SAMPLES; ATIKOKAN - 1981 - SAMPLES
CONSISTING OF DETRITUS ONLY WERE OMITTED DURING AVERAGING; 0 = NO ALGAE; - = SAMPLE NOT COLLECTED; + = PRESENT

MONTH	MAY																			
Location	Mamion Central		Able Lake		Anderson Dam		Mamion North		Snow Lake		Icy Lake		Moose Lake		Slush Lake		Mamion South		Lower Seine	
Depth	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m
Taxon																				
Attached Algae	0		0	0	0		0		0	0	0	0	0	0					0	0
Cyanophyta																				
Anabaena																				
Calothrix															20			90		
Dichothrix																				
Gloeotrichia																				
Lyngbya																5				
Phormidium																				
Plectonema		100																		
Schizothrix						100									20	7	100	10		
Stigonema																				
Rivulariaceae								100												
Chlorophyta																				
Bulbochaete																				
Cladophora sp																				
Cladophora glomerata															10					
Coleochaete																				
Mougeotia															25	1				
Oedogonium															25	21				
Rhizoclonium																62				
Spirogyra																				
Zygnema																				
Epiphytes																				
Chrysophyta																				
Cymbella															+	+				
Gomphonema																+				

TABLE 5-10

MEAN % COMPOSITION OF ATTACHED ALGAL SAMPLES: ATIKOKAN - 1981 - SAMPLES
CONSISTING OF DETRITUS ONLY WERE OMITTED DURING AVERAGING; 0 = NO ALGAE, - = SAMPLE NOT COLLECTED; + = PRESENT

MONTH	AUGUST																							
Location	Marmion Central		Able Lake		Anderson Dam		Marmion North		Snow Lake		Icy Lake		Moose Lake		Slush Lake		Marmion South		Lower Seine	
Depth	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m
Taxon																				
Attached Algae																				
Cyanophyta							0	0					0	0				0	0	
Anabaena			53																	
Calothrix	25	77	10		50	100			100	80	10	56			60	100	100			100
Dichothrix															3					
Gloeotrichia																				
Lyngbya				100																
Phormidium	75									20	70	15								
Plectonema																				
Schizothrix			10																	
Stigonema																				
Rivulariaceae					50										30					
Chlorophyta																				
Bulbochaete		23																		
Cladophora sp												2								
Cladophora glomerata												27								
Coleochaete																				
Mougeotia															7					
Oedogonium																				
Rhizoclonium																				
Spirogyra			1																	
Zygnema			6																	
Epiphytes																				
Chrysophyta																				
Cymbella																				
Gomphonema																				

TABLE 5-11

MEAN % COMPOSITION OF ATTACHED ALGAL SAMPLES: ATIKOKAN - 1981 - SAMPLES CONSISTING OF DETRITUS ONLY WERE OMITTED DURING AVERAGING; 0 = NO ALGAE; - = SAMPLE NOT COLLECTED; + = PRESENT

MONTH	OCTOBER																					
Location	Marmion Central		Able Lake		Anderson Dam		Marmion North		Snow Lake		Icy Lake		Moose Lake		Slush Lake		Marmion South		Lower Seine	
Depth	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m	1 m	3 m
Taxon																				
Attached Algae						-												0	0	0
Cyanophyta																				
Anabaena																				
Calothrix							10			13										
Dichothrix																				
Gloeotrichia	32		33		33		90	18												
Lyngbya	68	97	62	92	67			82	100	78	92	85	3		90	100	100			
Phormidium																				
Plectonema												3			10					
Schizothrix		1	3								8									
Stigonema																				
Rivulariaceae																				
Chlorophyta																				
Bulbochaete																				
Cladophora sp																				
Cladophora glomerata																				
Coleochaete																				
Mougeotia																				
Oedogonium				5																
Rhizoclonium										8		12	97	100						
Spirogyra																				
Zygnema			1	3																
Epiphytes																				
Chrysophyta																				
Cymbella	+											+	+	+						
Gomphonema																				

variations in species dominance in August were not consistent with depth. In October no algae were present at the 3 m depth in Marmion South and at the 1 and 3 m depths in Lower Seine. *Lyngbya* was the dominant species at thirteen locations, *Rhizoclonium* at two locations and *Gloeotrichia* at one location.

Epiphytes on the attached algae were rare, occurring on only a few samples in May and October. *Cymbella* was the most common genus.

The composition of attached algal communities in northern Canadian Lakes is not sufficiently documented to assess the typicality of the study lakes. However, the species composition in these lakes bears little resemblance to that described for Lake Winnipeg in Manitoba (Evans and Stockner, 1972) or for the experimental lakes in Northwestern Ontario (Stockner and Armstrong, 1971). In both these areas diatoms represented approximately 60% of the epilithic algae, with green algae being of secondary importance and blue greens of minor importance.

Biomass

Most of the samples collected for attached algal biomass determinations contained detritus as a major component. Consequently, the data (Appendix 4) obtained on dry and ash free dry weights were unrepresentative of algal biomass and they are, therefore, not reported in the text. However, the samples do indicate that biomass of attached algae in 1981 was negligible.

5.2.2 Macrophytes

Species Composition

A list of the species and the lakes in which they occurred is found in Table 5-12. The species include both those seen during the shoreline cruises and those seen during biomass sampling. Thirty species of submerged and floating leafed macrophytes, 14 emergents and 2 macrophytic algae (Charophytes) were observed during 1981. The species range from those generally considered typical of soft water habitats such as *Eriocaulon septangulare* (pipewort), *Lobelia dortmanna* (water lobelia) and *parganium fluctuans* (floating-leaf bur reed) (Hutchinson 1975, Crowder et al, 1977) to those generally considered typical of hard water such as *Elodea canadensis* (waterweed) (Hutchinson, 1975), *Potamogeton strictifolius* and *P. robbinsii* (Hellquist and Crow, 1980). This range in species type probably reflects the range in the geology of the study area which encompasses both acidic and basic rock types (Acres, 1976).

The largest number of species was recorded in Marmion Lake (35) followed by Abie (26), Snow (21), Lower Seine (15), Icy (15) and Slush (10) (Table 5-12). Species which were observed in all lakes include *Elodea canadensis* (waterweed), *Najas flexilis* (bushy pondweed) and *Potamogeton robbinsii* (Robbin's Pondweed). The latter two species were not reported in the results of the 1976 survey conducted by Acres Consultants, but were abundant in 1981. The Acres report incorrectly states that *Elodea canadensis*, a potentially problematic species, was not present in 1976. It is listed as *Philotria canadensis*, a name previously used for *Elodea canadensis* (St. John 1965), and was observed in Marmion, Snow and Lower Seine Lakes in 1976.

Distribution and Abundance

A characteristic of aquatic plant communities which was used to describe the vegetation in the study lakes was zonation. Zonation is associated with changes in water depth. Three zones are generally recognized in temperate lakes, but all are not necessarily present in every lake. These zones include a zone of emergent species in shallow water near shore, a zone of floating leafed species in deep water and a zone of submerged species in deeper water still (Curtis 1959, Hutchinson 1975). Sometimes the classic zonal pattern described above is only vaguely manifested, and the vegetation appears to be patchily distributed. The patchiness is likely a reflection of patchiness in environmental factors such as substrate, which can vary independently of water depth and which are important in controlling species distributions.

A detailed description of the areas surveyed by the divers follows. The areas are mapped in Figures 5-13 to 5-17. Since the aerial limits of the vegetation were not measured in the field, the boundaries in these Figures are only presented as an approximation of the extent of the vegetation.

Marmion Lake

The vegetation in Marmion Lake exhibited considerable diversity in the species composition and distribution among the areas sampled necessitating a separate description for each area.

Area 1, Figure 5-13

This bay was almost completely covered by aquatic vegetation which was dominated by pondweed species. *Potamogeton natans*, *P. zosteriformis*, *P. richardsonii* and *P. gramineus* were the most abundant, forming monospecific patches. Some parts of the bay, were densely vegetated by the needle rush, *Eleocharis acicularis*. This species achieves a height of only a few inches and gives a turf-like appearance to the vegetation. Scattered

TABLE 5-12

MACROPHYTE SPECIES LIST FOR THE ATIKOKAN STUDY LAKES

	Snow	Icy	Abie	Slush	Marmion	Lower Seine
Macrophytes						
Decodonta verticillata (Steud.) Fern					X	
Brasenia schreberi Gmel.			X			
Callitriche hermaphroditica L.		X			X	X
Callitriche heterophylla Pursh.					X	X
Ceratophyllum demersum L.					X	X
Eleocharis palustris (L.) R. & S.			X		X	
Eleocharis sp.		X	X		X	X
Elodea canadensis (Michx.) Rich.	X	X	X	X	X	X
Equisetum sp.	X		X		X	
Eriocaulon septangulare With.	X					
Glyceria grandis S. Watson					X	
Juncus effusus L.			X			
Lobelia dortmanna L.	X					
Mimulus ringens L.			X		X	
Myriophyllum alterniflorum D.C.	X				X	X
Myriophyllum exalbescens Fern.	X	X	X		X	X
Najas flexilis (Willd.) Rostk. & Schmidt	X	X	X	X	X	X
Nuphar sp.	X	X	X	X		
Nymphaea odorata Ait.	X	X	X	X		
Polygonum natans Eat.			X			
Potamogeton amplifolius Tuckerm.	X		X	X	X	X
Potamogeton epihydrus Raf.	X			X	X	
Potamogeton gramineus L.	X		X		X	
Potamogeton natans L.					X	X
Potamogeton pectinatus L.					X	
Potamogeton praelongus Wulfen.		X			X	
Potamogeton pusillus L.	X	X		X	X	
Potamogeton richardsonii (Benn.) Rydb.	X		X		X	X
Potamogeton robbinsii Oakes.	X	X	X	X	X	X
Potamogeton spirillus Tuckerm.		X			X	X
Potamogeton strictifolius Benn.		X				
Potamogeton vaseyi Robbins				X		
Potamogeton zosteriformis Fern.			X		X	
Ranunculus trichophyllus Chaix.	X	X	X		X	
Rorippa islandica (Oeder.) Borbas			X		X	
Sagittaria sp.	X		X		X	X
Scirpus cyperinus (L.) Kunth.					X	
Scirpus validus Vahl.					X	
Sium suave Walt.			X		X	
Sparganium fluctuans (Morong.) Robinson	X					
Typha angustifolia L.			X		X	
Typha latifolia L.			X		X	
Utricularia vulgaris L.	X	X	X	X	X	
Vallisneria americana Michx.	X		X			
Charophytes						
Chara sp.	X	X	X		X	X
Nitella batrachosperma (Reichenb.) A. Braun					X	
Total Number of Species	21	15	26	10	35	15

MAPS NOT FILMED

in the areas dominated by *Eleocharis* were a few tall, isolated stems of *Sium suave* (water parsnip) and *Mimmulus ringens* (monkey flower). An island in the centre of the bay was covered in parts by *Typha* sp (cattails). Other species observed in the bay which were uncommon include *Myriophyllum exalbescens* (water milfoil), *Callitriche hermaphroditica* (water starwort) and *Ceratophyllum demersum* (coontail).

Area 2, Figure 5-13

Cover in this bay ranged from approximately 100% in the south-west and extreme north-east to less than 25% in the central portion. Species composition varied considerably with the emergent *Typha* sp dominating the south-western parts up to a depth of about 1 m. In this area, there was an under-story of *Eleocharis acicularis* which extended into deeper water. *Najas flexilis* (bushy pondweed) and *Utricularia vulgaris* (bladderwort) occurred occasionally (<1% cover). Other species which were rare or locally abundant included *Mimmulus ringens*, *Potamogeton zosteriformis*, *P. gramineus* and *Equisetum* sp (horsetail).

Further east the water became very turbid and the vegetation up to approximately 1 m deep was dominated by *Potamogeton pectinutus* (sago pondweed) with an understory of *Chara* sp (musk grass) and *Najas flexilis*. *Equisetum* sp was distributed in dense patches in this shallow zone. In deeper water the substrate was carpeted by a continuous cover of *Eleocharis acicularis* with occasional *Sagittaria* sp (arrowhead) and *Ranunculus tricophyllus* (water crowfoot).

Throughout the central portion of the bay the cover averaged 25% or less with extensive areas devoid of submergent vegetation. A band of *Typha* sp lined the shore and was gradually replaced by a 3 to 5 m wide band of *Scirpus validus* (bullrush) towards the northeast. The most common submerged species was *P. gramineus* which occurred in monospecific patches or in mixtures with either *P. pectinatus* or *Eleocharis acicularis*. Some areas were dominated by *Eleocharis acicularis* mixed with *Najas flexilis* and *Chara* sp, but these were less frequent than the pondweed-dominated patches. Also present were *Potamogeton richardsonii*, *Rorippa islandica* (cress) and *Myriophyllum exalbescens*.

Islands located in the north-eastern part of the bay were surrounded by intermittent bands (up to 7 m wide) of *Typha* sp or *Eleocharis palustris*. Submerged vegetation was dominated by *Potamogeton gramineus* and *P. pusillus*.

Area 3 Figure 5-13

The vegetation in this bay was similar in composition to that in the north-eastern section of area 2. *Typha* sp lined the shore and formed small islands approximately 0.5 m in diameter in the bay. The substrate was covered by an *Eleocharis acicularis* carpet which was interrupted in places by patches of *Najas flexilis*, *Chara* sp and an aquatic moss. Other species observed include *Ceratophyllum demersum*, *Ultricularia vulgaris* and *Potamogeton richardsonii*.

Tall submergents (*Potamogeton pusillus*, *Ranunculus tricophyllus and Sagittaria* sp) were growing in deeper water (2 m deep). *Najas flexilis* and *Eleocharis acicularis* formed an understory. *Ceratophyllum demersum*, *Rorippa islandica* and *Myriophyllum exalbescens* were infrequent.

Area 6 - Figure 5-13

This bay was completely covered by aquatic vegetation except in areas where the substrate consisted of rocks 25 cm or more in diameter. The shore was lined with patches of spike rush (*Eleocharis* sp). The dominant nearshore submergent was *Eleocharis acicularis* which completely blanketed the bottom except in a few spots where *Chara* sp or *Nitella batrachosperma* were abundant. There were two overstory vegetation types associated with *Eleocharis acicularis* in the near-shore zone. The most common type was characterized by small clumps of *Sagittaria sp*, *Potamogeton richardsonii*, *P. zosteriformis* and *P. spirillus* which constituted <5% bottom cover. The second type was restricted to the back of the bay and was characterized by a dense cover of *Elodea canadensis* and *Vallisneria americana* (tape grass).

The deepest part of the bay was completely covered by a bed of *Ranunculus tricophyllus* which excluded all other species.

Area 9, Figure 5-13

The mouth of this bay was vegetated by a large stand of Typha sp. The inside of the bay was characterized by open water with a few standing dead trees. Submerged species present included *Polygonum natans* (smartweed), *Potamogeton spp* and water lilies (*Nuphar* or *Nymphaea*).

Areas 4, 5, 7, 8 10, 11 - Figure 5-13

Due to constraints of time the remaining areas on Marmion Lake were investigated with less intensity than those already described. Area 4 was dominated by *Typha* spp. Other emergents

included *Juncus* sp and *Equisetum* sp. *Potamogeton* spp were the most common submergents. The species composition in Area 5 was similar to that of Area 6 (described previously), while Areas 7 and 8 contained many dead standing trees. Area 7 also contained isolated clumps of *Typha* sp. Species present in Areas 10 and 11 included *Myriophyllum exalbescens*, *Potamogeton natans*, *P. gramineus*, *P. richardsonii*, *Nymphaea* sp and *Vallisneria americana*.

Abie Lake (Figure 5-14)

Abie Lake consists of two major basins which differed markedly in species composition and density of the aquatic vegetation. The north-east basin was the more densely vegetated of the two. This basin contained three bays of which the southwest (#1, Figure 5-14) had the greatest cover (100%). There were three major cover zones in this bay. The shore was lined by a dense mat of *Typha* sp with an occasional *Sium suave* (water parsnip) and *Sagittaria* sp. The surface of the second zone was about 75% covered with floating leaves of *Nymphaea odorata*. The understory varied from 25 to 100% cover of *Najas flexilis*, *Chara* sp, *Vallisneria americana* and *Potamogeton gramineus*. These species generally occurred in mixtures, except in a few areas where there were pure patches of pondweed. Other species observed in this zone were *Eleocharis acicularis*, *Sagittaria* sp, *Ultricularia vulgaris*, *Myriophyllum* sp, *Nuphar* sp, *Brasenia schreberi* and *Polygonum natans*. The third zone consisted of a *Potamogeton robbinsii* weedbed. Basically, the same species were found in the other two bays of the north-east basin (#2 and #3, Figure 5-14), but at a lower overall cover and density.

The vegetation in the second basin of Abie Lake was concentrated in three bays at the south end. The substrate was very rocky and in some areas there were large submerged tree stumps and logs. The emergents *Equisetum* sp and *Juncus effusus* formed small isolated patches a few meters in diameter on the shore. The substrate in shallow water was about 50% covered by *Eleocharis acicularis* which grew in between the rocks. Other species which were locally abundant were *Sagittaria* sp, *Polygonum natans*, *Mimmulus ringens* and *Sium suave*. In deeper water *Chara* sp and *Najas flexilis* formed an understory for *Nuphar* sp. *Potamogeton amplifolius* and *P. zosteriformis* occurred in mixed or pure patches near the submerged stumps. Other species growing near the stumps were *P. richardsonii*, *P. robbinsii*, *Elodea canadensis* and *Ranunculus tricophyllus*.

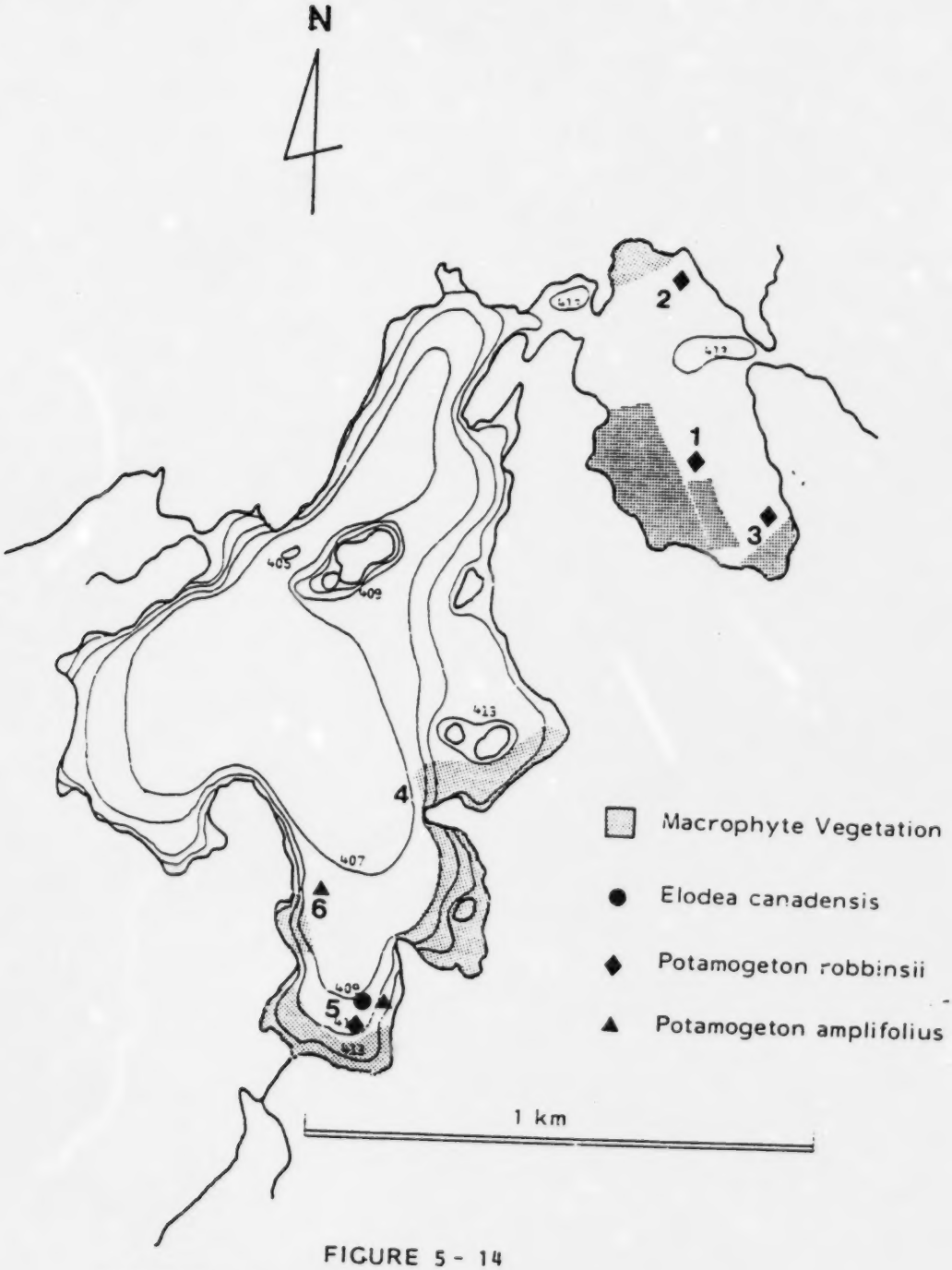

FIGURE 5 - 14

DISTRIBUTION OF MACROPHYTE VEGETATION OBSERVED ON ABIE LAKE IN 1981

(Species known to be photosynthetically active in winter are noted by symbols)

Icy Lake, Figure 5-15

There were four bays with extensive macrophyte cover in Icy Lake, three of which were sampled in detail. The long bay adjacent to Abie Lake (#1, Figure 5-15) was unique in that it was the only area in the study lakes where *Potamogeton strictifolius* was found. The species formed extensive beds mixed with *Elodea canadensis* along the sides of the channel. Also prominent were beds of *Potamogeton robbinsii* mixed with *Elodea canadensis*, *Najas flexilis* and occasional *Nymphaea odorata*. *Eleocharis* sp and *Potamogeton spirillus* were also present.

The two bays in the western end of Icy Lake (#2 and #3, Figure 5-15) were similar in species composition, but differed in total vegetative cover. Cover in the southern bay was 100%, except in water <15 cm deep where there were sections devoid of vegetation. There was more bare substrate in the northern bay. In vegetated near shore areas, *Utricularia vulgaris* formed extensive patches. Deeper water was dominated by *Potamogeton robbinsii* interrupted by patches and individuals of *Ranunculus tricophyllus* and occasional *Nuphar*. The understory consisted of *Chara* sp. and *Elodea canadensis*. *Potamogeton praelongus* was also observed, but was rare.

Snow Lake Figure 5-16

The vegetation in Snow Lake was concentrated in two bays along the north shore indicated in Figure 5-16. However, small patches of species such as *Nuphar* sp, *Potamogeton amplifolius*, *Sagittaria* sp, *Typha* sp and *Equisetum* sp were observed at other shoreline locations and at the mouth of the stream joining Snow to Icy Lake. *Elodea canadensis* formed an extensive floating mat near the proposed discharge, while smaller quantities were found in the two bays along the north shore and at the stream mouth.

The cover in the bay closest to the discharge (#1, Figure 5-16) ranged from 50 to 100%. Vegetation in shallow water consisted of patches of pure *Utricularia vulgaris*, patches of mixed waterlilies (*Nuphar* sp. and *Nymphaea odorata*), patches of *Lobelia dortmanna* mixed with *Eriocaulon septangulare* and a patch of *Potamogeton robbinsii* mixed with about 5% *Elodea canadensis*. Adjacent to the *P. robbinsii* was an area covered by *Chara* sp which contained small quantities of *Myriophyllum alterniflorum* and *Najas flexilis*. As the water became deeper the *Najas* gradually replaced the *Chara* until they were approximately equal in abundance. The overstory consisted of *Potamogeton gramineus*. The deepest water was vegetated by an approximately 50% cover of *P. robbinsii* with small clumps and isolated stems of *P. richardsonii*. *Vallisneria americana* and *Sparganium fluctuans* (burr reed) were also present in this bay.

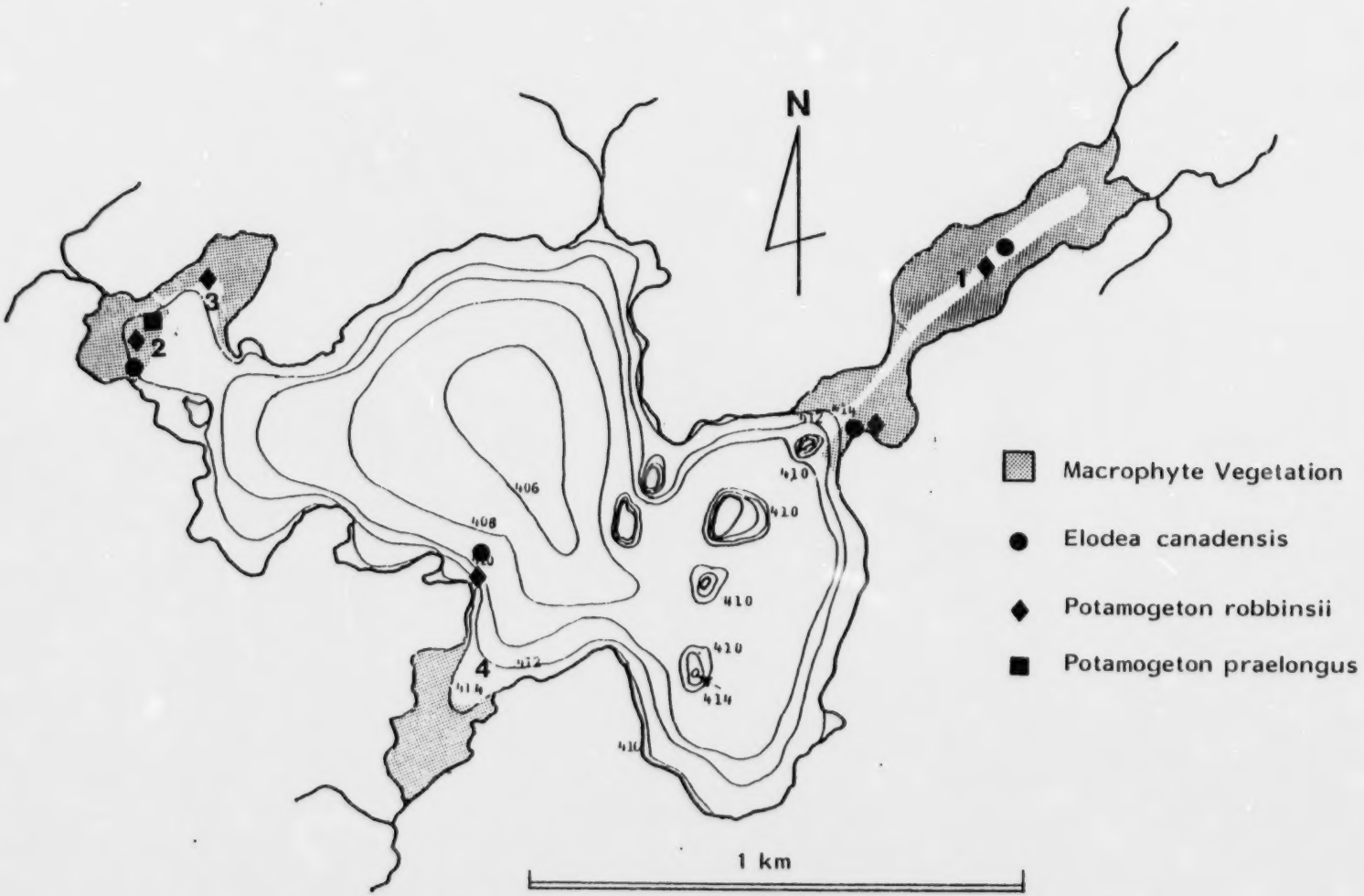

FIGURE 5 - 15

DISTRIBUTION OF MACROPHYTE VEGETATION
OBSERVED ON ICY LAKE IN 1981

(Species known to be photosynthetically active in winter are noted by symbols)

Macrophyte Vegetation

Elodea canadensis

Potamogeton robbinsii

Potamogeton amplifolius

Myriophyllum alterniflorum

FIGURE 5-16

DISTRIBUTION OF MACROPHYTE VEGETATION OBSERVED ON SNOW LAKE IN 1981

(Species known to be photosynthetically active in winter are noted by symbols)

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The cover in the second bay was lower than in the first (approximately 50%), but the species composition appeared similar.

Three of the species found in Snow Lake were not found elsewhere during the 1981 survey. These were *Eriocaulon septangulare*, *Lobelia dortmanna* and *Sparganium fluctuans*. All are considered softwater species (Hutchinson 1975, Crowder et al 1977). However, species generally considered typical of hard water (eg, *Elodea canadensis* (Hutchinson 1975) and *Potamogeton robbinsii* (Hellquist and Crow 1980)) were more abundant and widespread in Snow Lake.

Slush Lake, Figure 5-17

This lake was selected as a control lake prior to the survey. It was found to differ from the cooling circuit lakes in the low number of species observed and the low overall vegetative cover. This was the only lake where *Potamogeton vaseyi* was observed and the only lake with no *Chara* sp. *Chara* was common in all other lakes. Similarly, *Elodea canadensis* was common in the other lakes, but was not observed during the August survey of Slush Lake. However, it was collected during biomass sampling. This suggests that its abundance in Slush Lake is relatively low.

The vegetation was most abundant in two small bays on the east shore. *Utricularia vulgaris* was dense in shallow water. A bed of *Potamogeton robbinsii* grew in deeper water. The bed was interrupted by patches consisting of varying proportions of *P. vaseyi*, *P. amplifolius* and *Najas flexilis*. An area of large boulders near the mouth of one of the bays was dotted with white and yellow water lilies.

Lower Seine, Figure 5-13

This lake was also selected as a potential control prior to the survey. Only one bay where the vegetation was visually most similar to that of parts of the cooling circuit lakes was surveyed in detail. This bay was adjacent to the transect used for biomass sampling. *Eleocharis acicularis* mixed with small quantities of *Najas flexilis* and *Chara* sp blanketed the bottom. The dominant floating leafed species was *Sagittaria* sp which constituted about 15 to 20% cover.

Potamogeton richardsonii was the most common pondweed. *Myriophyllum alterniflorum*, *P. spirillus*, *P. natans* and *Callitriche heterophylla* were present in low abundance.

Macrophyte Vegetation

Elodea canadensis

Potamogeton robbinsii

Potamogeton amplifolius

FIGURE 5-17

DISTRIBUTION OF MACROPHYTE VEGETATION
OBSERVED ON SLUSH LAKE IN 1981
(Species known to be photosynthetically active in winter are noted by symbols)

As with Slush Lake, *Elodea canadensis* was not observed during the August survey, but was collected during biomass sampling. This suggests a low abundance of *Elodea* in Lower Seine, but this statement is tentative since the survey of this lake was less thorough than that of the other lakes.

Biomass

The dry weights (g/m^2) of samples collected in May, August and October are presented in Appendix 5. The August samples from Marmion Lake South, Lower Seine Bay and Abie Lake were lost in transit before processing. No samples were collected from Slush Lake in May or from Icy Lake at the 3-m depth in October. Water level manipulations in May produced unnaturally high levels resulting in the inclusion of terrestrial species in the biomass samples at the 1-m depth. These samples were probably not representative of May biomass for aquatic species.

The means and standard deviations of the August and October samples are shown in Table 5-13. The highest mean standing crop was recorded at the 3-m depth in Lower Seine Lake in October. At most locations, the maximum mean occurred in August. Overall, the values are low relative to the standing crops reported for similar species at sites used as controls in a study of the effects of thermal effluents on aquatic vegetation in Lake Wabamun, Alberta (Haag and Gorham, 1977). However, the locations sampled for biomass in this study were along the regular sampling transects and did not necessarily include areas where, as judged from the shoreline survey in August, the vegetation was very productive.

The variances (s^2) (Table 5-13) associated with the replicate samples are high (generally greater than the means) suggesting that a large number of samples is needed to obtain a good estimate of the mean biomass (Snedecor and Cochran, 1967). To reduce the number of samples required it is necessary to reduce the variance among the replicates. This could perhaps be accomplished by incorporating stratification into the sampling design (Nichols 1982). Among the characteristics which could be used for stratification are plant community type, substrate type and location of the macrophyte beds in relation to prevailing winds and nutrient sources. Sampling different plant community types is one factor which is thought to have contributed significantly to the large sample variances in 1981. For example, two of the May samples from Marmion Lake Central were composed of an aquatic moss and the third of *Myriophyllum* sp mixed with *Potamogeton zosteriformis*. The moss has a different growth form and a lower potential for biomass production than either *Myriophyllum* sp or *P. zosteriformis* resulting in a high variance when the samples are combined.

TABLE 5-13

MEAN AND STANDARD DEVIATION OF THE MACROPHYTE BIOMASS (g/m^2) SAMPLES
- ATIKOKAN - 1981 -

Month	May 14 - 19				August 6 - 12				October 5 - 8			
Depth	1 m		3 m		1 m		3 m		1 m		3 m	
Location	$\overline{X}$	S	$\overline{X}$	S	$\overline{X}$	S	$\overline{X}$	S	$\overline{X}$	S	$\overline{X}$	S
Anderson Dam	4.8	3.0	9.6	4.2	12.8	3.0	40.4	33.1	2.0	1.2	34.0	3.0
Marmion Lake North	12.8	3.9	0	0	17.2	12.4	18.8	23.2	16.0	13.2	34.8	16.4
Marmion Lake Central	8.8	6.5	3.6	1.8	9.1	6.1	5.3	1.8	5.0	4.2	0	0
Marmion Lake South	6.0	1.4	12.8	5.6	NS	NS	NS	NS	35.1	14.8	37.2	14.8
Lower Seine Bay	*0.5	0.4	NS	NS	NS	NS	NS	NS	36.7	13.5	77.6	9.0
Abie Lake	4.8	4.7	0	0	NS	NS	NS	NS	4.3	2.4	8.0	5.2
Icy Lake	2.8	2.4	0	0	5.2	0.7	0	0	4.4	2.1	NS	NS
Slush Lake	NS	NS	NS	NS	13.5	10.3	6.0	2.9	10.0	9.6	2.8	0.7
Snow Lake	6.8	1.7	0	0	12.3	11.9	5.1	7.6	8.8	6.2	0	0

* = Sample taken at 2-m depth
$\overline{X}$ = mean
S = Standard Deviation
NS = no sample

As a consequence of the high variances between the replicates, the high water levels in May and the missing samples, it was not possible to determine spatial patterns in macrophyte biomass.

Vegetation Assessment

1. Rare Species

Of the species listed in Table 5-12 only *Potamogeton vaseyi* (a pondweed) is on the list of rare species in Ontario (Argus and White, 1977). This species was only found in one bay in Slush Lake. Although not on the list compiled by Argus and White, the water starwort, *Callitriche hermaphroditica*, is also rare in Ontario, but its presence in lakes in the Atikokan area is probably not unusual since the species is relatively common in Western Canada (G. Miller, MOE, pers comm).

2. Fish and Wildlife Usage

Most of the species found in the study area are valuable as a source of food or cover for wildlife, particularly for ducks and occasionally for beaver, deer, moose, muskrat and porcupine. A list of the plant species utilized by wildlife, compiled from Fassett (1975) and Martin et al (1951), is presented in Appendix 5.

Vegetated areas are important to some of the common fish species in the area by providing spawning grounds for sport fish, such as yellow perch and northern pike, and forming part of the habitat of forage fish, such as blacknose shiner and Iowa darter (Scott and Crossman, 1973). Northern pike use weedbeds dominated by *Potamogeton robbinsii*, in particular, for shelter (Fassett, 1975). *P. robbinsii* was one of the most abundant and widespread aquatic plants in the study lakes.

3. Distribution and Abundance

Species with known habitat preferences and of limited distribution in the present survey include the soft water species, *Eriocaulon septangulare* and *Lobelia dortmanna*. These were only observed in Snow Lake and probably reflect local geological conditions.

In the introduction to the macrophyte distribution and abundance section, it was noted that the vegetation within temperate lakes typically exhibits a zonal distribution pattern with emergent species in shallow water, floating leafed species in deeper water and submerged species in deeper water still.

Such a zonal pattern was apparent in the Atikokan GS study lakes, but overall, submerged species were dominant. The submerged species were usually stratified into two layers with pondweeds (*Potamogeton* spp) dominating the upper layer and species such as muskgrass (*Chara* sp), needle rush (*Eleocharis* of *acicularis*) and bushy pondweed (*Najas flexilis*) dominating the lower layer. Emergent vegetation was generally lacking except in a few areas where there were large stands of cattails (*Typha* sp) or spike rushes (*Eleocharis palustris*). Floating leafed species consisted mainly of waterlilies (*Nymphaea odorata* and *Nuphar* sp) and some of the pondweeds *Potamogeton* spp).

Overall, the vegetative cover was highest in sheltered bays with scattered clumps of vegetation or single plants occurring in more open areas. Vegetation was absent where bedrock was the major component of the substrate and where the sides of a lake were steeply sloped.

4. Recreation

The following bays contain vegetation of sufficient height and density to constitute an impediment to swimmers or boaters:

Marmion Lake - Figure 5-12 - #1, parts of #2, #3, #4, #5, #6, #9
Abie Lake - Figure 5-13 - #1, #3
Icy Lake - Figure 5-14 - #1, parts of #2, #3 and #4
Snow Lake - Figure 5-15 - parts of #1 and #2.

5. Potentially Problematic Species

The effects of thermal effluents on aquatic vegetation are not well documented. Of the literature that is available, the study conducted by Haag and Gorham (1977) on the submerged macrophytes in Lake Wabamun, Alberta, is particularly pertinent to the Atikokan study due to the similarity of species composition. Following commissioning of the Wabamun Generating Station and the Sundance Power Plant, *Elodea canadensis* increased in biomass and extended its distribution to such an extent that it became a recreational nuisance. The increased proliferation of *Elodea* was attributed to the absence of a winter ice cover in part of the lake and to the lack of a dormancy mechanism in this species which permitted growth during winter (Haag & Gorham, 1977). In addition to *Elodea canadensis*, the following species are known to remain photosynthetically active in winter and were present in the study lakes: *Myriophyllum alterniflorum, Potamogeton amplifolius, P. praelongus and P. robbinsii* (Boylen and Sheldon 1976). The distribution of the species is shown in Figures 5-13 to 5-17. It is unlikely that this list of species which are photosynthetically active in winter is exhaustive, since this aspect of aquatic plant biology is not well documented (Boylen and Sheldon *loc.cit.*).

5.2.3 Phytoplankton

Species Composition (Appendix 6)

In terms of mean seasonal algal biomass, the Pyrrophyta (flagellates including dinoflagellates and cryptomonads) was the most important algal group present in the study area. It was the main group present in Snow Lake, Slush Lake, Icy Lake, Abie Lake, Anderson Dam and Moose Lake (Table 5-14). The Bacillariophyta (diatoms) was the main group present at Marmion South, Lower Seine Lake, Marmion Central and Marmion North. The flagellates were the second most abundant algae at the latter four locations. The Cyanophyta (blue-green algae) made up a large portion of the phytoplankton biomass in Moose and Slush Lakes. The chlorophyta (green algae) was important in Snow as well as Slush Lakes while the Chrysophyta (golden algae) were more important in Abie and Moose Lakes than in the remaining lakes. Schindler and Holmgren (1971) who studied the mid-summer phytoplankton of the ELA Lakes in northwestern Ontario found the chrysophytes to be the largest algal group in those lakes. They found the diatoms to be important only in some lakes while the flagellates were an important part of the algal biomass in all lakes. Blue-green algae were present in all of the ELA Lakes although no blooms were observed. With the exception of one of their study lakes (Lake 99) they found the green algae to be insignificant quantitatively.

The number of phytoplankton taxa identified during the sampling season ranged between 26 at Slush Lake and Marmion Central and 41 at Snow Lake. Slush Lake was found to be the basin with lowest nutrient levels (see Section 5.1.3).

The flagellate *Cryptomonas* sp was the main algal taxon present at all locations except Marmion South, Lower Seine, Marmion Central and Marmion North where the diatom *Melosira granulata* followed by *Cryptomonas* was the main contributor to algal biomass over the sampling season. Other taxa that were found at all locations were *Aphanizomenon flos-aquae*, *Coelospharium* sp, *Elakatothrix gelatinosa*, *Asterionella gracillima*, *Dinobryon* sp and *Rhodomonas minuta*. Taxa that were not widespread, but were important members of the phytoplankton at some locations included *Oscillatoria* sp in Slush and Moose Lakes and *Coelastrum* in Snow Lake. *Tabellaria fenestrata*, which was present in all lakes except Moose Lake, was an important alga in Lower Seine Lake and at Marmion South.

Melosira spp, *Asterionella* spp, *Fragilaria crotonensis*, *Synedra* spp and *Stephanodiscus* sp dominate the phytoplankton of highly productive lakes although they are common in both eutrophic and oligotrophic waters (Hutchinson 1967). The

TABLE 5-14

MEAN PER CENT COMPOSITION OF PHYTOPLANKTON
ATIKOKAN 1981

	Snow Lake	Slush Lake	Icy Lake	Able Lake	Marmion South	Lower Seine	Marmion Central	Marmion North	Anderson Dam	Moose Lake
Cyanophyta	2.4	16.8	7.5	0.9	9.2	9.6	5.0	8.2	6.4	26.5
Anabaena sp	0.3	0.2	1.0	0.2	1.0	0.4	0.5	0.9		0.5
Anabaena flos-aquae	0.1		1.1	0.3	1.8	0.9	2.0	1.5	0.6	3.7
Anabaena planctonica	0.5		0.5	0.1	1.6	2.1	0.9	0.4	3.8	
Anacystis sp		<0.1				<0.1				
Aphanizomenon flos-aquae	0.1	0.1	0.4	<0.1	0.9	1.9	0.6	2.2	1.1	0.2
Aphanocapsa sp					0.2					3.4
Chroococcus spp		4.8	3.3		1.3	1.0	0.9	2.9	0.5	0.3
Chroococcus dispersus						2.6				
Coelosphaerium spp	1.3	3.0	1.0	0.3	0.3	0.6	0.1	0.3	0.4	1.8
Lyngbya sp			<0.1							
Merismopedia sp	0.1									
Microcystis sp	<0.1	1.8	0.2	<0.1	0.1	<0.1				0.6
Oscillatoria sp		6.9			2.0					16.0
Chlorophyta	23.7	10.6	0.6	0.3	1.1	2.1	0.2	1.1	0.4	1.0
Ankistrodesmus falcatus	<0.1	0.2	<0.1	<0.1		<0.1		0.2	0.1	<0.1
Asterococcus superbus			0.4							
Coelastrum sp	20.0									
Cosmarium sp	1.1	8.5				1.2				0.6
Crucigenia sp	0.1	0.1			<0.1	<0.1		<0.1	0.1	<0.1
Elakatothrix gelatinosa	0.2	<0.1	0.1	0.1	0.1	0.1	0.1	0.1	<0.1	0.1
Haematococcus sp				<0.1						
Micractinium sp					<0.1	0.2	<0.1		<0.1	<0.1
Micractinium pusillum						<0.1				
Oocystis sp	1.0	1.4			0.2	0.2	0.1	0.3	0.2	0.2
Quadrigula sp	<0.1							<0.1		
Scenedesmus bijuga	<0.1	<0.1	0.1	<0.1				<0.1	<0.1	<0.1
Scenedesmus quadricauda								<0.1		<0.1
Selenastrum sp	0.1			0.1		<0.1				
Spondylosium sp										0.1
Spondylosium planum	0.6				0.8			0.5		
Staurastrum sp						0.1				
Staurastrum longispina	0.5									
Tetraedron minimum		0.4		0.1	<0.1	0.1				
Bacillariophyta	32.3	7.5	33.9	37.5	48.7	46.8	71.0	45.8	22.0	6.3
Asterionella formosa	<0.1									
Asterionella gracillima	1.0	2.8	6.6	2.2	3.0	5.6	2.0	5.3	3.2	0.9
Cymbella sp	0.1		0.3	0.1		<0.1				
Diatoma sp			0.2	<0.1			<0.1			<0.1
Diatoma elongatum	0.1	0.2	0.2	0.1	<0.1			0.1	0.2	0.1
Fragilaria sp	0.1		0.1		0.1					
Fragilaria crotonensis	0.6	0.2	3.3	0.1	0.3	0.1			0.2	0.2
Rhoicosphenia curvata				0.6						
Synedra sp	0.2		0.3	0.3					0.2	
Synedra ulna					2.8		0.8			
Tabellaria sp	0.1					0.7				
Tabellaria fenestrata	0.8	1.6	7.7	2.9	12.6	22.4	4.8	8.4	7.8	
Cyclotella sp									0.2	0.2
Melosira sp	3.2		0.4	1.6		2.0		4.6		4.2
Melosira granulata	20.6		11.6	28.4	28.2	12.7	62.6	25.7	8.2	
Pennales (unidentified)	2.4	2.7	0.7	<0.1		0.9	<0.1	0.4	0.1	
Rhizosolenia sp	3.2		2.5	1.2	1.7	2.4	0.8	1.3	1.9	0.7
Stephanodiscus sp				<0.1					<0.1	
Chrysophyta	7.1	6.5	3.2	11.1	1.9	5.5	2.0	6.1	8.4	10.6
Bitrichia chodotti	<0.1		<0.1	<0.1	<0.1	<0.1				
Dinobryon sp	3.0	1.9	2.1	7.4	1.0	1.6	0.8	1.1	2.7	1.5
Dinobryon crenulatum	0.1		<0.1		<0.1		<0.1	<0.1		
Dinobryon bavaricum	1.1	1.3	0.1	0.1	0.3	0.5	0.2	1.8	0.6	
Dinobryon divergens		1.0				1.3				
Dinobryon sertularia	1.7			1.3	0.3	1.9	0.3	1.9	5.1	2.7
Mallomonas sp	1.0	2.3	1.0	0.3	0.3	0.2	0.4	1.2		0.3
Mallomonas pseudocoronata	0.2									
Ochromonas sp				0.1						5.9
Unidentified				0.1		0.8	0.3	0.1		0.2
Pyrrophyta sp	33.5	56.7	54.2	50.2	38.0	34.5	21.5	38.2	62.5	54.8
Cryptomonas sp	24.8	48.1	38.8	35.5	27.8	20.9	14.9	23.9	47.2	40.8
Rhodomonas minuta	7.3	8.6	12.3	11.9	7.6	6.8	3.9	9.5	12.6	8.7
Ceratium hirundinella					2.6	6.1	1.1	2.8	2.7	1.6
Peridinium sp	1.4		3.1	2.8		0.7	1.6	2.0		3.7
Unidentified	1.0	1.9	0.3	0.1	0.6	0.6	<0.1	0.2	0.3	0.7
Unidentified			0.3	0.3	0.3	0.5	0.1	0.4		

cryptomonads, *Cryptomonas* and *Rhodomonas* contain several species that are of considerable importance in the nanoplankton of lakes (Hutchinson 1967).

Temporal Distribution

The seasonal phytoplankton composition by division, and seasonal changes in total algal biomass for Snow Lake, Slush Lake, Icy Lake and Abie Lake are shown in Figure 5-18. Those for Marmion South, Lower Seine Lake and Marmion Central are shown in Figure 5-19 and for Marmion North, Anderson Dam and Moose Lake in Figure 5-20.

Snow Lake

The diatoms dominated the phytoplankton of Snow Lake on the first sampling date of the season (June 4). The diatom dominance at this time was probably part of the spring diatom increase. The flagellates made up the largest portion of the standing crop in late June. The dominance shifted to the green algae in July and back to the flagellates in August. The diatoms dominated again through the fall and the flagellates in the winter. *Rhizosolenia* and *M. granulata* were the two main diatoms present on June 4, and *M. granulata* was the dominant diatom present in the fall. *Cryptomonas* was the dominant flagellate present on the sampling dates that this group predominated. *Coelastrum* was the main green algae present in July.

Total algal biomass declined through June and increased again in July, when highest standing crop was observed (560 mg m^{-3}). The biomass dropped in August and then peaked again in the fall.

Slush Lake

Only in Slush Lake were the flagellates the dominant phytoplankton group present on all sampling dates. The dominant flagellate present on each sampling date was *Cryptomonas*. Maximum algal biomass in Slush Lake was observed in November (609 mg m^{-3}).

Icy Lake

The phytoplankton of Icy Lake was dominated by the flagellates on all sampling dates except June 4 and September 22, when the diatoms dominated. *Cryptomonas* was the main flagellate present on the sampling occasions when the flagellates were the main group present. *M. granulata* was the dominant diatom present on June 4 and September 22.

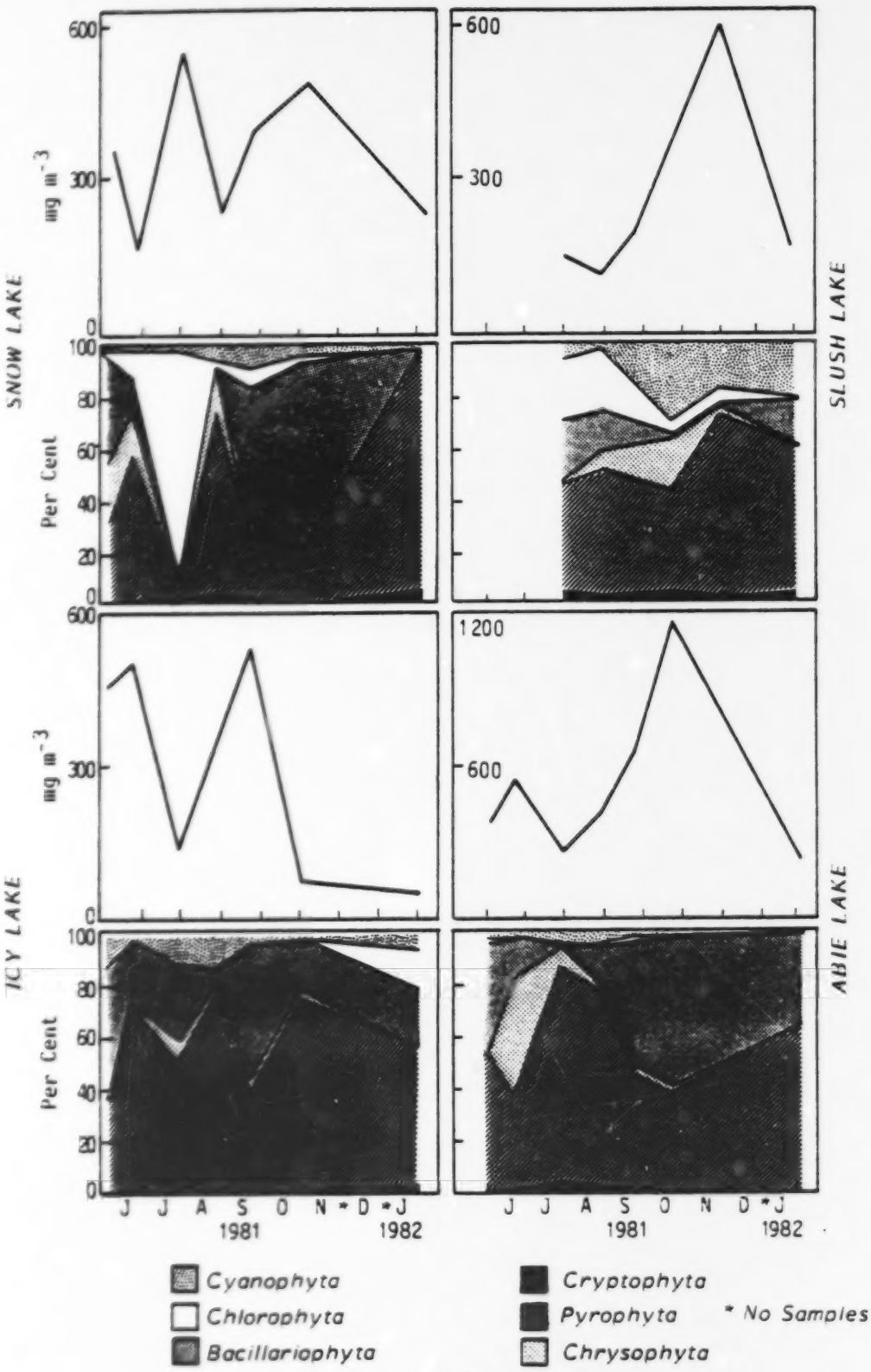


FIGURE 5-18

SEASONAL CHANGES IN TOTAL PHYTOPLANKTON BIOMASS AND PERCENT COMPOSITION OF PHYTOPLANKTON IN SNOW LAKE, SLUSH LAKE, ICY LAKE AND ABIE LAKE, JUNE 1981 - FEBRUARY 1982, ATIKOKAN GS PREOPERATIONAL STUDY, YEAR 1

158550 RD

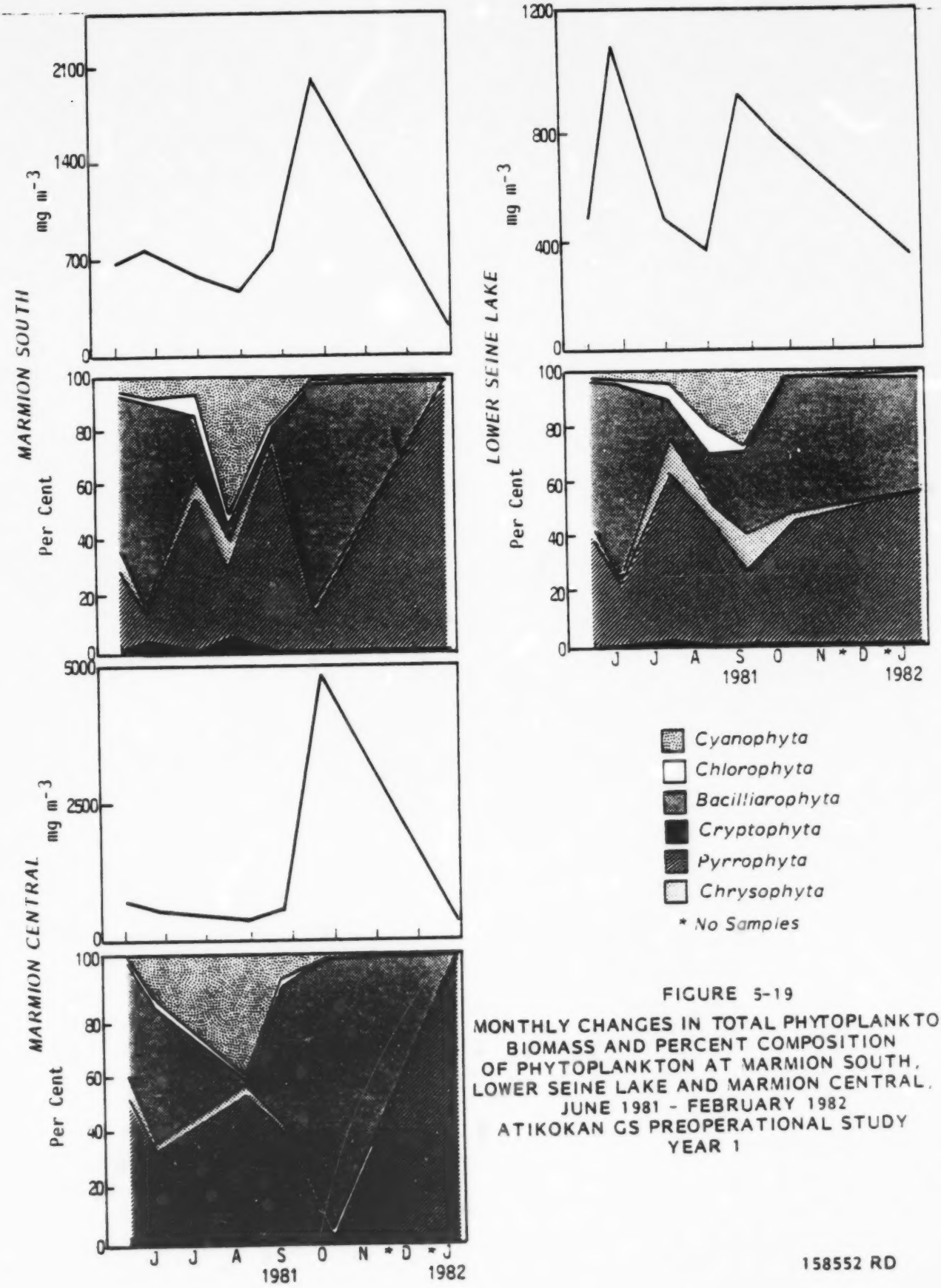


FIGURE 5-19

MONTHLY CHANGES IN TOTAL PHYTOPLANKTON BIOMASS AND PERCENT COMPOSITION OF PHYTOPLANKTON AT MARMION SOUTH, LOWER SEINE LAKE AND MARMION CENTRAL, JUNE 1981 - FEBRUARY 1982
ATIKOKAN GS PREOPERATIONAL STUDY
YEAR 1

158552 RD

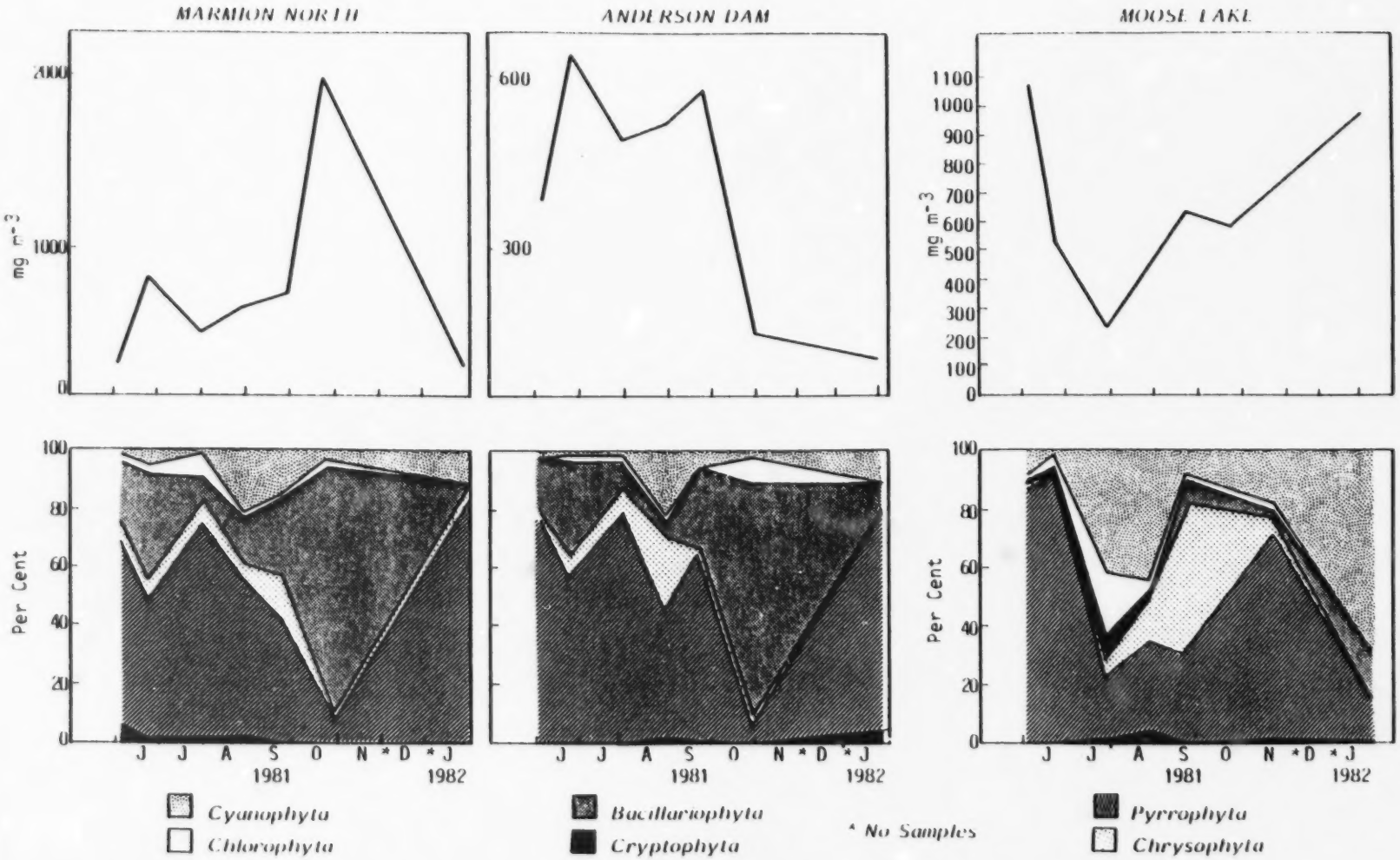


FIGURE 5 20

SEASONAL CHANGES IN TOTAL PHYTOPLANKTON BIOMASS AND PERCENT COMPOSITION OF PHYTOPLANKTON AT MARMION NORTH, ANDERSON DAM AND MOOSE LAKE, JUNE 1981 FEBRUARY 1982, ATIKOKAN GS PREOPERATIONAL STUDY, YEAR 1

158551 RD

The phytoplankton biomass in this lake declined through July and increased again in August and September reaching an early fall peak (529 mg m^{-3}).

Abie Lake

The flagellates were the main algae present in Abie Lake in early June followed by the golden algae in late June. The flagellates then dominated for the rest of the summer followed by the diatoms in the fall. The flagellates were dominant again in the winter. *Cryptomonas* was the main flagellate present on the occasions when this group made up the largest portion of the algal biomass. *Dinobryon* was the main golden algae present in late June and *M. granulata* was the dominant diatom present in the fall.

The algal biomass increased slightly in June, decreased through July and increased again between August and late October when a peak was observed (1161 mg m^{-3}).

Marmion Lake

The sampling sites in Marmion Lake (including Lower Seine) displayed similar patterns of species composition through the sampling period. Diatoms were relatively abundant in early summer and in October. The contribution of diatoms in the phytoplankton samples from June was greatest at the southerly locations (Lower Seine and Marmion South) and least in the northerly locations (Anderson Dam and Marmion North). Flagellates were relatively abundant on all sampling dates and were the most abundant or second most abundant group during the summer and winter. Bluegreen algae were most abundant during August and September.

T. fenestrata and *M. granulata* were generally the most common diatoms in the early summer and fall, respectively. *Cryptomonas* was the most common flagellate through most of the year.

Algal biomass varied among dates and locations. Marmion South, Central and North had a single biomass peak in October, whereas Anderson Dam and Lower Seine Lake had peaks in late June and September.

Moose Lake

The phytoplankton of Moose Lake differed most from the phytoplankton at the other locations. It was dominated by the blue-green algae in July, August and February. The only other location at which the blue-greens dominated, on a single sampling date only, was Marmion South. *Anabaena flos-aquae*, *Aphanocapsa*

and *Oscillatoria* were the main blue-green algae present on July 28, August 27 and February 1, respectively. Most *Aphanocopsa* species have been found to show a preference for soft water acid habitats (Prescott 1962). *Cryptomonas* was the dominant flagellate present in June and November and *Ochromonas* was the main flagallate present in September.

The algal biomass in Moose Lake was higher in February than that estimated on the sampling occasions between late June and October. At the remaining locations seasonal low standing crop was generally found in February. Highest total phytoplankton biomass was estimated in early June (1075 mg m^{-3}).

The water level in Moose Lake had been reduced considerably during the spring of 1981, prior to our study period. In addition it was in the area most affected by construction activity. These factors may have influenced the phytoplankton of this lake.

Overview

There was some variation in the seasonal structure of the phytoplankton at the various locations sampled. The flagellates were the predominant algae present on the winter sampling date in all lakes. The diatoms were the main group present in late fall in all lakes except Slush, Icy and Moose Lakes where the flagellates dominated at this time. With the exceptions of Abie Lake, Marmion South and Moose Lake, the phytoplankton was dominated by either the diatoms or flagellates on the remaining sampling occasions. In terms of phytoplankton Moose Lake appeared to be most different from the other study lakes due to the importance of the blue-green algae in this lake.

Cryptomonas and *R. minuta* were found on each sampling date in all lakes. Taxa that occurred on each sampling date in at least one lake included; *Ankistrodesmus falcatus*, *Dinobryon*, *Anabaena flos-aquae*, *Cymbella*, *Synedra*, *Melosira* sp, *Tabellaria* sp, *Tetraedron minimum* and a group of unidentified pennales. *Oscillatoria* and *Cyclotella* were only found in fall and winter samples, and *Asterococcus superbus* was only found in the winter sample from Icy Lake.

There were also differences in the seasonal changes of the total algal biomass at the ten locations sampled. The pattern was most different at Moose Lake where biomass increased between November and February. At most other locations algal biomass was higher in the early summer and in the fall with lower biomass estimated in mid-summer and in the winter.

Total phytoplankton biomass was lower in Icy Lake, Snow Lake, Slush Lake and Anderson Dam than at the remaining locations with highest biomass found at Marmion Central. The mid-summer standing crop estimated for our study lakes were similar to those ELA lakes with lower mid-summer algal biomass (Schindler and Holmgren 1971).

Although the nutrient status of Icy Lake and Anderson Dam was relatively high (see Section 5.1.3) the total phytoplankton biomass was relatively low. Slush Lake which was relatively nutrient poor also had low algal biomass. Consequently observed phytoplankton biomass was not consistently related to nutrient status of the lake.

5.2.4 Zooplankton

Species Composition (Appendix 7)

Keratella cochlearis, *Kellicottia longispina* and *Polyarthra* spp were the main rotifers present in the study area. In oligotrophic lakes of the temperate zone these three taxa plus *Synchaeta (oblonga, tremula* and *pectinata)*, *Conochilus unicornis*, *Asplanchna priodonta* and *Filinia terminalis* are generally found to predominate (Ruttner-Kolisko 1974). Of the latter four taxa all but *F. terminalis* were common in all lakes included in this study. Pejler (1962, 1965) observed that *K. cochlearis*, *K. longispina* and *Polyarthra vulgaris* were dominant in most oligotrophic lakes, and *Gastropus stylifer*, *A. priodonta*, *P. remata*, *Conochilus* spp and *Ascomorpha ovalis* were common. Schindler and Novén (1971) noted that Pejler's (1962, 1965) observations agree with their findings for the ELA lakes in northwestern Ontario in 1968-1969. Although a large portion of *Gastropus* in our samples could not be postively speciated due to contraction of the animals upon preservation, most of them appeared to belong to the species *G. stylifer*. Therefore, except for *A. ovalis*, the rotifers found to be common by Pejler (1962, 1965) in oligotrophic lakes, and by Schindler and Novén (1971) for the ELA lakes were also common in our study lakes. Other taxa found to be common in both the ELA Lakes and our study lakes included *Filinia longiseta*, *Trichocerca cylindrica* and *Conochiloides dossuarius*. *Keratella quadrata* which was common in our study area was not identified by Schindler and Novén for the ELA lakes (1971). According to Ruttner-Kolisko (1974) *F. longiseta*, *T. cylindrica* and *K. quadrata* are usually present in eutrophic lakes of the temperate zone, although their distribution is not limited to these lakes.

The mean relative abundances (Table 5-15) of the rotifers for the study period indicate that *K. cochlearis* was the most

abundant rotifer followed by either *K. longispina*, *Polyarthra* spp or *Gastropus* spp in all lakes except Slush Lake where *K. longispina* was the most abundant species. Slush Lake also had a higher representation of *K. longiseta* than the remaining lakes. Acres (1976) found *K. cochlearis*, *Asplanchna* and *Polyarthra* to be the dominant rotifers in the same study area in 1975-1976. Acres studied the zooplankton of all lakes included in our study with the exception of Slush Lake.

The number of rotifer taxa identified at each location over the study period ranged from 16 in Slush Lake to 30 in Icy Lake.

The cyclopoid copepods were the most abundant crustacean zooplankton in all lakes (Table 5-16). *Diacyclops bicuspidatus thomasi* and *Mesocyclops edax* were the only two cyclopoid copepod species identified with the former found in considerably higher abundance in all the lakes. The calanoid copepods made up the second largest portion of the crustacean numbers. *Diaptomus oregonensis* was the main calanoid copepod present in the lakes. *D. minutus*, present in all of the lakes, occurred in substantially lower numbers than *D. oregonensis* while *D. sicilis* was only found at Marmion Central. In most of the 45 ELA lakes studied by Schindler and Noven (1971), either *Diacyclops bicuspidatus thomasi* or *Diaptomus minutus* was the numerically dominant crustacean zooplankton.

Daphnia galeata mendotae was the main cladoceran found in Slush Lake, Abie Lake, Marmion South, Lower Seine and Moose Lake while *Bosmina longirostris* was the most abundant cladoceran present in Snow Lake, Icy Lake, Marmion Central and Anderson Dam. *Ho..pedium gibberum* was the main cladoceran found at Marmion North. Other cladocerans common in the study area included *Diaphanasoma leuchtenbergianum* and *Daphnia longiremis* which were present at all locations. *D. retrocurva* was present in all lakes except Slush, and *Ceriodaphnia lacustris* and *Chydorus sphaericus* were taken in all lakes except Abie. Less common species found in the study area included *D. pulex*, *D. parvula*, *D. ambiqua* and *Eubosmina coregoni*. The latter three species were not recorded for the ELA lakes in 1968-1969 (Schindler and Novén, 1971) although they are species commonly found in various parts of Ontario. Acres (1976) reported *D. bicuspidatus thomasi* as the dominant cyclopoid copepod and *D. minutus* and *D. sicilis* as the dominant calanoid copepods in the study area in 1975-1976. The dominant cladocerans identified by Acres (1976) were *B. longirostris*, *Diaphanasoma brachyurum*, *D. galeata mendotae*, *Chydorus* sp and *Ceriodaphnia*.

TABLE 5-15

SPECIES COMPOSITION (JUNE, 1981 - FEBRUARY, 1982) OF ROTIFERS IN LAKES INCLUDED IN THE ATIRDEAN CS PREOPERATIONAL STUDY - YEAR 1, 1981

Location	Snow Lake	Bluch Lake	Icy Lake	Abte Lake	Marmion South	Lower Seine	Marmion Central	Marmion North	Anderson Pond	Moose Lake
Taxa										
Brachionus angularis	0.1						<0.1		0.1	
Brachionus sp	<0.1									
Epiphanes sp										
Kellicottia bostoniensis			<0.1							
Kellicottia longispina	5.2	25.6	8.3	16.6	8.5	18.0	14.0	24.8	6.6	28.9
Keratella cochlearis	71.9	19.8	65.7	39.2	71.9	53.0	35.0	62.4	62.9	61.6
Keratella earlinae										
Keratella hiemalis	<0.1	2.8	0.2	0.1		<0.1		0.3	<0.1	0.1
Keratella quadrata	0.4	1.6	10.8	0.2	0.4	0.7	0.6	0.4	0.2	0.3
Notholca acuminata			<0.1							
Notholca squamula	<0.1		<0.1	<0.1						<0.1
Notholca spp			<0.1							
Lepadella spp			<0.1			<0.1				
Lecane bulla	<0.1	0.8	0.1		0.1	0.1	0.4	0.1	0.1	0.8
Lecane lunae	<0.1				<0.1					
Lecane luenaris			<0.1		<0.1	<0.1	0.2			
Lecane spp					<0.1			0.1	<0.1	
Trichocerca cylindrica	0.1	0.7	<0.1	0.1	0.1	0.1	0.1	0.2	0.1	<0.1
Trichocerca elongata	<0.1									
Trichocerca longiseta	0.1	0.1	<0.1	0.2	0.3	0.1	0.5	0.3	0.2	0.1
Trichocerca multicrinis	0.4		<0.1	0.6	0.1	<0.1	0.3	0.2	0.5	
Trichocerca porcellus	<0.1		<0.1	0.1	0.2	0.1	1.5	0.3	0.8	0.1
Trichocerca pusilla					<0.1					
Trichocerca spp		0.2	0.1					<0.1	0.1	
Ascomorpha spp			0.1	0.2	<0.1	<0.1				
Gastropus stylifer	0.3		<0.1				0.3			<0.1
Gastropus spp	6.3	4.0	2.8	12.6	4.4	8.4	15.1	9.0	5.2	2.8
Asplanchna priodonta	0.8	2.9	0.5	1.7	2.7	1.1	1.8	1.3	0.6	0.4
Asplanchna spp	1.3	5.3	2.0	5.8	3.5	3.1	7.2	3.3	3.0	2.0
Ploesoma triacanthus			0.1	0.7	<0.1	0.1	0.2	<0.1	<0.1	<0.1
Ploesoma spp	0.2									
Polyarthra minor			<0.1							
Polyarthra spp	10.8	16.1	7.7	17.1	4.9	11.2	15.9	10.1	14.1	7.5
Synchaeta spp	0.1	0.3	0.4	0.5	0.2	0.3	0.3	0.8	0.3	0.7
Filinia longiseta	0.2	16.8	0.2	0.4	0.1	0.3		<0.1	0.2	1.7
Filinia terminalis	<0.1		<0.1		<0.1		0.1			
Pompholyx spp	0.5									
Hexarthra mira			0.1	<0.1		<0.1	0.2	<0.1	0.1	
Conochiloides dossuarius	0.6	1.4	0.5	2.7	1.6	2.2	4.1	4.3	3.8	10.1
Conochilus hippocrepis				0.4						
Conochilus unicornis	0.4	1.6	0.2	0.9	1.0	1.1	2.5	2.0	1.2	2.8
Collotheca pelagica	<0.1				<0.1	<0.1				
Unidentified Rotifera	0.4			<0.1		<0.1	0.1	0.3		0.1

TABLE 5-16

SPECIES COMPOSITION (JUNE, 1981 - FEBRUARY, 1982) OF CRUSTACEAN ZOOPLANKTON IN LAKES INCLUDED IN THE ATIKOKAN GS PREOPERATIONAL STUDY - YEAR 1, 1981

Location	Snow Lake	Slush Lake	Icy Lake	Able Lake	Marmion South	Lower Seine	Marmion Central	Marmion North	Anderson Lake	Mouse Lake
Taxa										
Cladocera										
Diaphanosoma leuchtenbergianum	2.1	2.9	0.5	1.6	0.5	0.1	1.1	1.6	0.2	0.1
Holopedium gibberum	1.9	2.9	1.2	1.0	1.5	1.8	1.8	8.7	0.1	0.4
Daphnia pulex		0.2	0.6	0.4	0.1	0.1	0.1	0.2		
Daphnia longiremis	0.3	0.2	1.5	2.0	0.6	1.1	0.6	1.0	0.6	0.5
Daphnia retrocurva	0.2		0.2	0.1	0.3	0.7	0.6	1.1	0.6	2.2
Daphnia galeata mendotae	3.0	3.6	6.9	10.5	5.3	5.0	6.1	7.4	6.0	15.5
Daphnia pervula			0.5	0.4	0.1	0.2			<0.1	0.1
Daphnia ambigua					<0.1					
Daphnia spp	1.0	1.1	1.2	0.9	0.6	0.5	0.6	2.0	0.5	1.2
Ceriodaphnia lacustris	0.4	0.3	1.0		0.1	0.2	0.4	0.5	0.5	<0.1
Ceriodaphnia spp	0.3									
Bosmina longirostris	12.4	2.9	11.7	5.5	2.7	2.5	7.4	4.2	17.9	13.6
Eubosmina coregoni	0.2		0.2	<0.1	0.1	<0.1	0.1			0.1
Chydorus sphaericus	0.7	0.7	<0.1		0.2	0.2	0.2	0.2	<0.1	0.1
Calanoid Copepods										
Diaptomus oregonensis (CVI)	14.3	13.0	4.3	4.4	6.0	5.1	7.1	5.6	4.3	13.7
Diaptomus minutus (CVI)	2.5	0.8	2.6	2.1	1.6	2.1	2.3	1.8	2.2	2.8
Diaptomus sicilis (CVI)							0.2			
Calanoid copepodites (CI-CV)	4.1	4.9	3.1	2.4	5.3	4.7	4.7	6.0	4.5	2.4
Calanoid nauplii	10.0	11.8	10.5	21.2	9.6	14.9	9.1	8.1	10.1	7.8
Cyclopoid Copepods										
Diacyclops bicuspidatus thomasi (CVI)	11.6	16.6	13.6	7.3	8.6	18.6	12.9	12.1	9.6	8.3
Mesocyclops edax (CVI)	1.3	2.3	1.8	1.5	2.5	1.6	2.1	1.7	1.9	1.3
Cyclopoid copepodites (CI-CV)	19.4	13.0	21.5	11.7	34.4	22.3	26.5	23.5	26.5	9.9
Cyclopoid nauplii	14.3	22.9	17.2	27.1	20.6	18.4	16.1	14.1	14.5	18.8

Temporal Distribution

Seasonal changes in the abundance of the main zooplankton taxa found in Snow, Slush, Icy and Abie Lakes are shown in Figure 5-21. For Marmion South, Lower Seine Lake and Marmion Central they are shown in Figure 5-22, and for Marmion North, Anderson Dam and Moose Lake in Figure 5-23.

Snow Lake

The rotifers in Snow Lake were dominated by *K. cochlearis* throughout the sampling season. It made up from 38% of the rotifer numbers in late July to 83% in June. *K. cochlearis* and *K. longispina* were found on each sampling date while *Polyarthra* was only absent from the June 4 sample. Largest number of taxa were found in the late June sample (16).

K. cochlearis was most abundant on June 4 (93 111 m^{-3}). This species also had a fall density peak. Highest densities of *Polyarthra* and *K. longispina* were found in the fall (21 945 and 5 278 m^{-3} respectively).

The cyclopoid copepods dominated the crustacean zooplankton on all sampling dates. The cyclopoid nauplii and copepodites and *Diacyclops bicuspidatus thomasi* adults together made up between 42% (July 28) and 68% (February 1) of the total numbers. The largest number of taxa were identified in the July 30 sample (13).

In this lake the cyclopoid nauplii peaked first in late June (4 630 m^{-3}) followed by the cyclopoid copepodites in late July (6 778 m^{-3}) and the *D. bicuspidatus thomasi* adults (4 074 m^{-3}) in late August. The number of nauplii increased again in late August (7 130 m^{-3}) coincident with the adult peak. The copepodite numbers were high through the fall reaching a seasonal maximum (8 750 m^{-3}) in late October. The adult and nauplii numbers also increased again in the fall. Thus there appears to have been at least two generations of *D. bicuspidatus thomasi* in this lake. In the case of the calanoid copepods, the adult *Diaptomus oregonensis* peaked first in late July (4 444 m^{-3}) followed by the nauplii in late August (3 981 m^{-3}) with both increasing again slightly in early November. The density of the copepodites was lower than that of the nauplii and *D. oregonensis* adults on all sampling dates with maximum numbers found in early November (1 806 m^{-3}). *Bosmina longirostris* was found in peak abundance in the fall (10 605 m^{-3}) while *Daphnia galeata mendotae* was found in highest densities during the summer (1 444 m^{-3}).

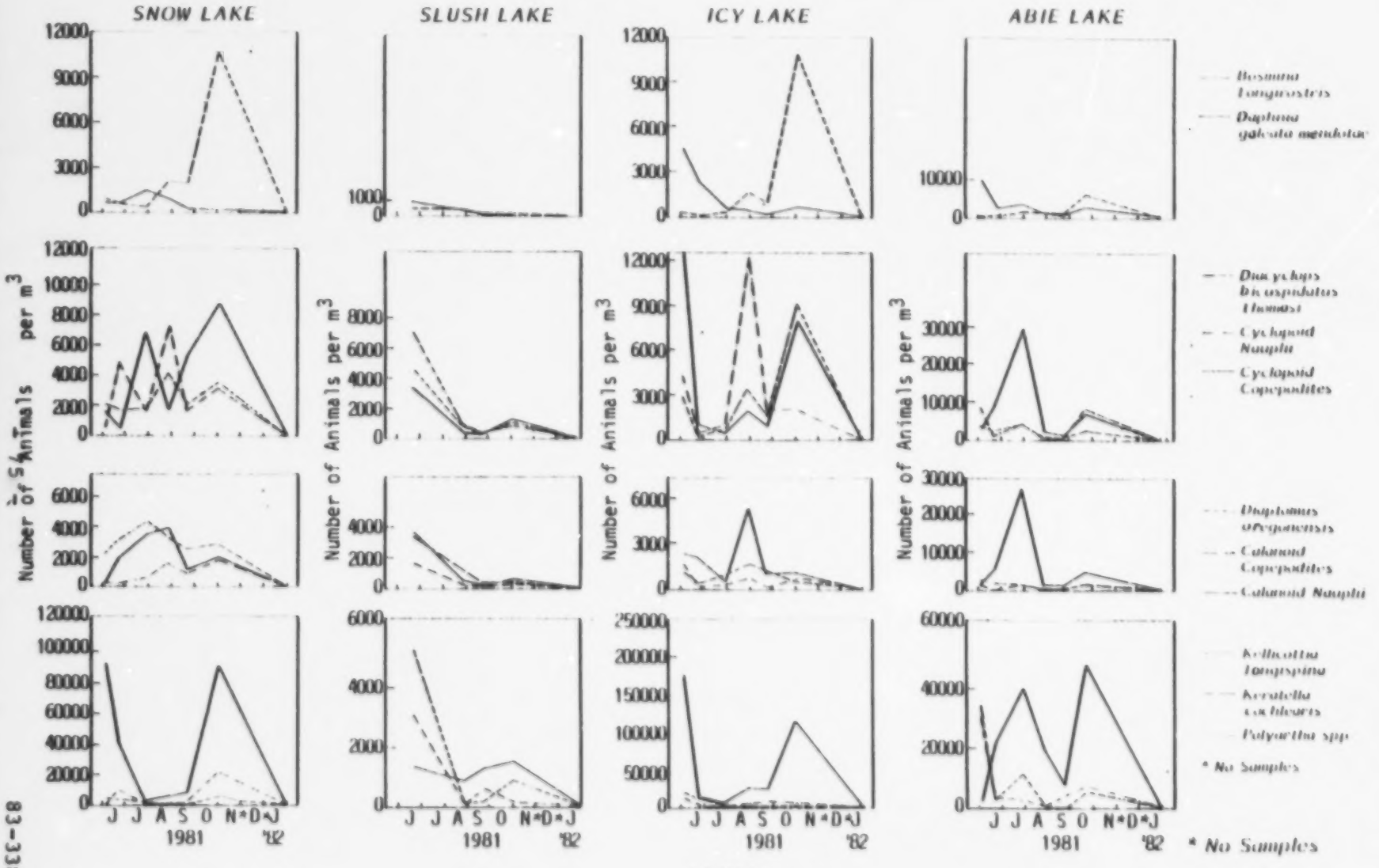


FIGURE 5-21

MONTHLY ABUNDANCE OF DOMINANT CRUSTACEAN ZOOPLANKTON AND ROTIFERS IN SNOW LAKE, SLUSH LAKE, ICY LAKE AND ABIE LAKE, JUNE 1981 FEBRUARY 1982, ATIKOKAN GS PREOPERATIONAL STUDY YEAR 1

83-338 15855A RD

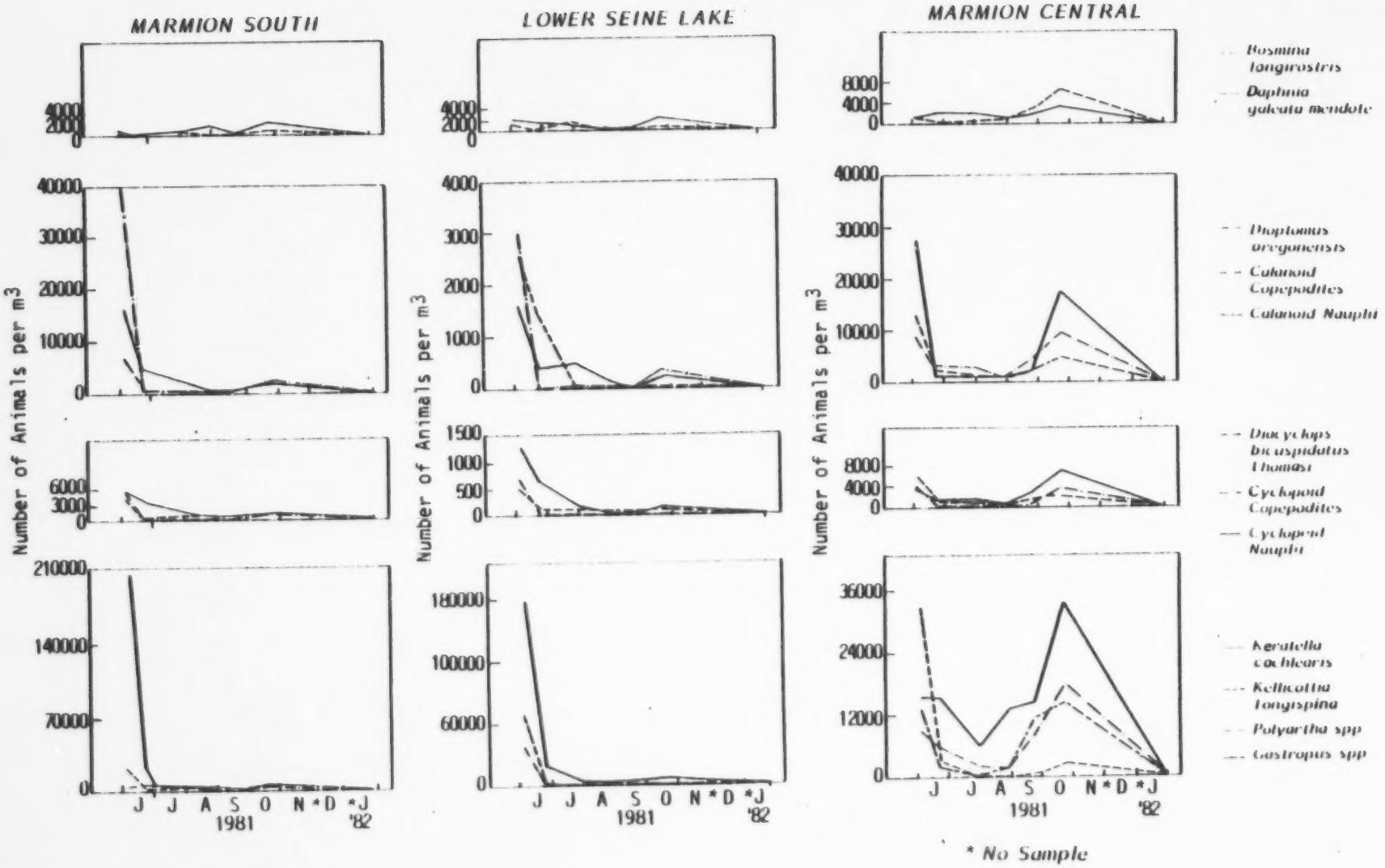


FIGURE 5-22

SEASONAL ABUNDANCE OF DOMINANT CRUSTACEAN ZOOPLANKTON AND ROTIFERS IN MARMION SOUTH, LOWER SEINE AND MARMION CENTRAL, JUNE 1981 - FEBRUARY 1982
ATIKOKAN GS PREOPERATIONAL STUDY - YEAR 1

158549 RD

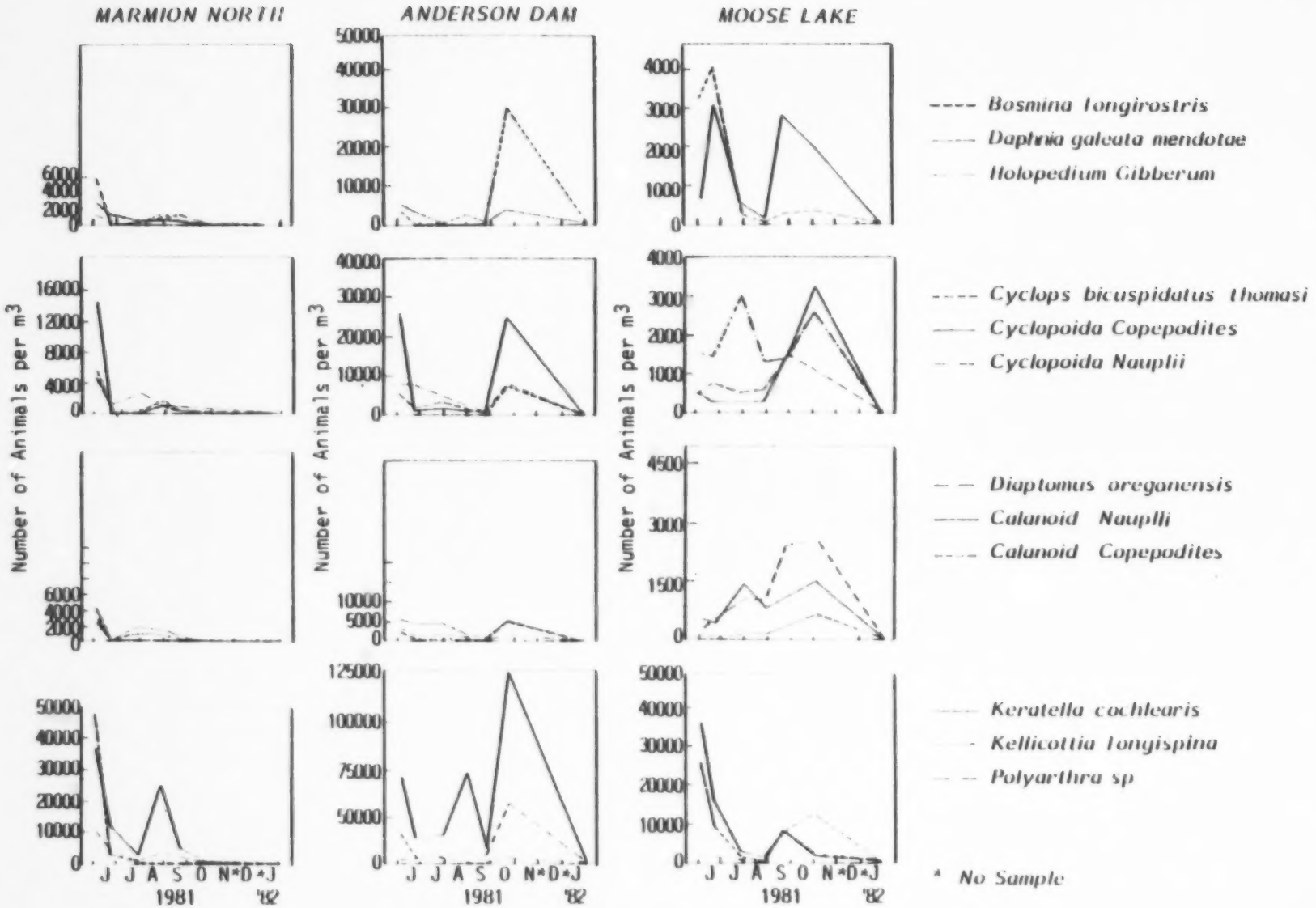


FIGURE 5.23

SEASONAL ABUNDANCE OF DOMINANT CRUSTACEAN ZOOPLANKTON AND ROTIFERS IN MARMION NORTH, ANDERSON DAM AND MOOSE LAKE, JUNE 1981 FEBRUARY 1982
ATIKOKAN GS PREOPERATIONAL STUDY YEAR 1

158553 RD

Slush Lake

K. longispina was the dominant rotifer present in Slush Lake in June (30%) and February (22%) while *K. cochlearis* dominated on the remaining three sampling dates (45-55%). The largest number of taxa were identified in the June sample (14).

K. longispina and *Polyarthra* were found in maximum abundances in late June (5 247 and 3 086 m^{-3}, respectively). The density of *K. cochlearis* did not vary much between June and November when highest numbers were found (1 518 m^{-3}).

The cyclopoid copepods dominated the crustaceans on all sampling dates making up between 33% (August 27) and 92% (February 1) of the total numbers. Largest number of crustacean taxa (11) were found in July.

Highest densities of the cyclopoid nauplii and copepodites, *D. bicuspidatus thomasi* adults (7 099, 3 395 and 4 568 m^{-3} respectively), calanoid nauplii and copepodites, and *D. oregonensis* adults (3 705, 1 605 and 3 395 m^{-3}, respectively) were found on June 4 with slight increases in their densities observed again in late fall. *B. longirostris* and *D. galeata mendotae* were most abundant on June 4 (927 and 494 m^{-3}, respectively).

Icy Lake

K. cochlearis was the most abundant rotifer present in Icy Lake on all sampling dates. Its relative abundance ranged from 38% (June 22) to 77% (June 4). The largest number of taxa were identified on June 29 (17).

Highest density of *K. cochlearis* was found on June 4 (177 986 m^{-3}) with a lesser density peak observed in the fall. The seasonalities of *K. longispina* and *Polyarthra* were quite similar to that of *K. cochlearis* with maximum numbers found in early June (24 187 and 13 125 m^{-3}, respectively) and a lesser peak observed in the fall.

The cyclopoid copepods dominated the crustacean zooplankton of Icy Lake on all sampling dates except July 22 when the calanoid copepods were more abundant (33%). The cyclopoid nauplii and copepodites, and *D. bicuspidatus thomasi* adults made up between 36% (July 29) and 60% (June 4) of the total numbers on the days that they dominated. The largest number of crustacean taxa were found on July 29 (13).

The fluctuation in the densities of the cyclopoid nauplii and copepodites, and *D. bicuspidatus thomasi* adults indicates that

this species had at least two generations in Icy Lake. The numbers of cyclopoid nauplii during the study period was highest in August (11 481 m^{-3}). The large number of cyclopoid copepodites present on June 4 (12 639) would indicate that there must have been an earlier peak of nauplii. The number of cyclopoid copepodites increased slightly in August and again in early November. The *D. bicuspidatus thomasi* adults declined in June, increased slightly in August and increased to a seasonal high in November (8 056 m^{-3}). The calanoid nauplii declined in numbers in June and July and then increased to a maximum in late August (5 556 m^{-3}). The calanoid copepodites were found in highest numbers on June 4 (1 667 m^{-3}) while the adult *D. oregonensis* numbers declined in June and increased again between the end of June and August when they were found in maximum numbers (1 667 m^{-3}). *B. longirostris* peaked in early November (10 834 m^{-3}) while *D. galeata mendotae* was most abundant on June 4 (4 444 m^{-3}).

Abie Lake

K. cochlearis was the main rotifer present on all sampling dates except June 4 when *K. longispina* was abundant (35%). On the remaining dates *K. cochlearis* made up between 31 and 79% (February 1) of the rotifer numbers. Maximum number of rotifer taxa (14) in Abie Lake were found in July, August and September.

K. cochlearis had a mid-summer peak and a late fall peak when highest densities occurred (47 777 m^{-3}). *K. longispina* and *Polyarthra* were found in maximum abundance on June 4 (34 555 and 30 778 m^{-3} respectively). *K. longispina* had subsequent lesser peaks in July and October. The density of *Polyarthra* also increased in late fall.

The cyclopoid copepods dominated the crustacean zooplankton of Abie Lake on all sampling occasions. The cyclopoid nauplii and copepodites, and adult *D. bicuspidatus thomasi* made up between 38% (September 23) and 62% (February 1) of the total numbers. The largest number of crustacean taxa (11) were collected in July and August.

The cyclopoid nauplii had a main density peak in July (29 555 m^{-3}) and a lesser one in October. The cyclopoid copepodite numbers declined in June and increased slightly in July and again in October (8 444 m^{-3}). The densities of *D. bicuspidatus thomasi* adults did not fluctuate much with highest numbers found in late July (4 000 m^{-3}). The calanoid nauplii peaked in July (7 111 m^{-3}) and increased again slightly in October. Largest numbers of calanoid copepodites were found in October (1 444 m^{-3}) and highest numbers of *D. oregonensis*

adults were found in June (2 778 m^{-3}) *B. longirostris* had a fall peak (5 778 m^{-3}) while *D. galeata mendotae* was most abundant on June 4 (10 111 m^{-3}).

Marmion Lake

With the exception of Marmion Central and North on June 4, *K. cochlearis* was the most abundant rotifer on all sampling dates at all locations. *K. longispina* was the most abundant rotifer at Marmion Central and North on June 4. *K. cochlearis* comprised from 26% of the rotifer numbers on October 24 at Marmion North to 80% on July 4 at Marmion South. Largest number of rotifer taxa were observed at all locations in July, August or September.

K. cochlearis generally, exhibited two peaks in abundance, one on June 4 and a second in late summer or fall. Largest density of *K. cochlearis* was approximately 208,000 m^{-3} on June 4 at Marmion South. According to Wetzel (1975) rotifer densities of 200,000 to 300,000 m^{-3} are common. Other rotifer taxa, *K. longispina* and *Polyarthra* were also relatively abundant in June.

The cyclopoid copepods were the most common crustacean zooplankters on all dates at Marmion Central, North and Anderson Dam and all but one date at Marmion South and Lower Seine. They ranged from 29% to 77% of the crustacean samples with lowest relative abundance in the summer and highest on June 4 or February 1. Largest number of crustacean taxa were identified in summer samples.

Highest densities of the cyclopoid nauplii and copepodites and *D. bicuspidatus thomasi* adults were generally observed on June 4. A peak was also observed in the fall at Marmion Central and Anderson Dam. Relatively high densities of calanoid nauplii and copepodites and *Diaptomus oregonensis* adults were observed on June 4 at the three most southerly locations, Marmion South and Central and Lower Seine. A fall peak in their abundance was only observed at Marmion Central. Of the remaining crustacean zooplankters, a fall peak in abundance of *Bosimina longirostris* was observed at Marmion Central and Anderson Dam.

Moose Lake

K. cochlearis outnumbered the other rotifer taxa found in Moose Lake on all sampling dates except September 22 when *Gastropus* spp (29%) was more abundant, and on February 2 when *K. longispina* (50%) was more abundant. On the dates that *K. cochlearis* was dominant it made up between 41% (June 4) and

65% (August 27) of the rotifer numbers. The largest number of rotifer taxa were found in June (12).

K. cochlearis and *K. longispina* were most abundant on June 4 (36 667 and 26 000 m^{-3}). Both taxa increased again in the fall with *K. cochlearis* reaching a fall peak in late September and *K. longispina* in early November. *Polyarthra* was found in highest densities in late September (8 481 m^{-3}).

The cyclopoid copepods dominated the crustaceans on all sampling dates except June 4 and 22 when *B. longirostris* was dominant (39 and 35%, respectively). The relative abundance of the cyclopoid nauplii and copepodites plus the adult *D. bicuspidatus thomasi* ranged from 21% (June 22) to 5.2% (February 1). The largest number of taxa identified in a sample (11) was found in the June 4, August 27 and November 2 samples.

The densities of the crustacean zooplankton were comparatively low in this lake. The cyclopoid nauplii were most abundant in July (3 005 m^{-3}). Their numbers increased again in November. The largest numbers of cyclopoid copepodites were found in November (3 305 m^{-3}) while the adult *D. bicuspidatus thomasi* were highest in September (1 528 m^{-3}). The abundances of the calanoid nauplii and copepodites, and adult *D. oregonensis* were highest in November (1 500, 666 and 2 833 m^{-3}, respectively). *B. longirostris* and *D. galeata mendotae* were most abundant in June (3 250 and 3 133 m^{-3}, respectively). The density of *B. longirostris* declined through August and stayed low for the remainder of the year while that of *D. galeata mendotae* increased again in September.

Overview

The abundance of the main rotifers varied substantially among sampling locations. The rotifer densities were considerably lower in Slush Lake than in the remaining lakes and higher densities were found in Icy Lake, Marmion South and Lower Seine.

The discussion on the seasonal distribution of the rotifers has been limited to those of the three main taxa found in each lake. In most lakes these included *K. cochlearis*, *K. longispina* and *Polyarthra*. These three taxa appeared to occur perennially and in most lakes had high early summer densities, indicative of spring population peaks, followed by low summer densities and a subsequent fall density peak.

The largest number of rotifer taxa were present during the summer.

The densities of the crustacean zooplankton in the lakes also varied although not as much as the rotifer densities. Moose Lake followed by Slush Lake had the lowest numbers of crustacean

zooplankton mainly due to the lower densities of the cyclopoid copepods in those lakes.

At most sampling locations the cyclopoid copepods dominated the crustacean zooplankton on all or all but one sampling date. The largest number of taxa were generally found in the summer months.

Crustacean zooplankton that appeared to occur perennially in at least one of the study lakes included: *Diacyclops bicuspidatus thomasi* (nauplii, copepodites and adults), *Mesocylops edax*, *Diaptomas oregonensis* (nauplii, copepodites and adults), *D. minutus*, *Bosmina longirostris*, *Daphnia galeata mendotae*, *D. longiremis*, *Holopedium gibberum*, *Chydorus sphaericus* and *Eubosmina coregoni*. In most lakes *Diaphanasoma leuchtenbergianum* was only found in the summer to mid-fall. This species was described by Pejler (1965) as a warm water form.

The discussion on the seasonal distribution of the crustaceans has been limited to those of the main species present in each lake.

Since *Diacyclops bicuspidatus thomasi* adults occurred in much higher numbers than *Mesocyclops edax*, the only other cyclopoid copepod found in the lakes, it was assumed that most of the cyclopoid nauplii and copepodites belonged to this species. At all locations except Snow Lake, Abie Lake and Moose Lake the densities of the cyclopoid nauplii and copepodites, and adult *D. bicuspidatus thomasi* were on the decline in June, indicating that spring density peaks had occurred. In Slush Lake, Marmion South, Lower Seine Lake, Marmion Central and Anderson Dam, low summer densities were followed by an increase in numbers in late fall. At Marmion North their numbers stayed low for the remainder of the year. *D. bicuspidatus thomasi* has been reported to enter summer diapause (Hutchinson, 1967). In our study area this species never completely disappeared from the lakes during the summer months and summer density peaks were observed in Snow, Icy, Abie and Moose Lakes indicating that this species did not enter summer diapause in those lakes. Similarly, Schindler and Nován (1971) did not observe *D. bicuspidatus thomasi* to enter summer diapause in the ELA Lakes 122 and 132.

In the case of the calanoid copepods, *Diaptomus oregonensis* adults outnumbered the adults of the other calanoid copepod species and the nauplii and copepodites were assumed to consist mainly of *D. oregonensis*. Except in Snow, Abie and Moose Lakes, the densities of the calanoid nauplii and copepodites, and *D. oregonensis* adults declined through June indicating that a spring population peak had occurred. In Slush Lake, Marmion South, Lower Seine Lake and Anderson Dam numbers stayed low or

increased again in the fall while at Marmion North numbers increased slightly in mid-summer.

With the exception of Snow Lake, succession patterns in the seasonal distribution of the various stages (nauplii, copepodites, adults) of the copepods were not obvious, probably due to the large sampling intervals (monthly). The number of copepod larvae are normally considerably higher than those of the juveniles and adults. This was generally not the case in our study lakes, however, major pulses in the densities of the nauplii may have been missed due to the large time period between sampling intervals. The seasonal pattern of *D. bicuspidatus thomasi* in Snow Lake indicates that there were at least two generations. Schindler and Noven (1971) found two generations in lake 122 of the ELA. *D. bicuspidatus thomasi* and *D. oregonensis* females with egg sacs attached were found in most of the lakes on the winter sampling date (February 1, 1982) indicating a continuation of the reproductive cycle during the ice cover period.

The densities of *B. longirostris* was substantially higher at Anderson Dam than at the remaining locations. In most lakes this species was observed to have a fall population peak. *D. galeata mendotae* occurred in higher densities in the summer in most lakes.

The densities of the main crustacean species estimated for our study area are comparable to those estimated for the ELA Lakes 122 and 123 (Schindler and Noven 1971) as well as those estimated for the study area by Acres (1971).

5.2.5 Zoobenthos

A benthic sampling program was implemented consisting of two objectives:

1) determine spatial variation in taxonomic composition across the watershed, and relate these variations to depth and substrate. Single Ekman grab samples were to be taken (no replication), thus relying on the numerically more dominant taxa to identify variation.

2) determine spatial variation in benthic densities by means of triplicate grab samples collected in mid-winter. It was hoped that the benthic distribution would be sufficiently homogeneous so that triplicate sampling would be adequate.

The Distribution of Zoobenthic Taxa During "Summer" Sampling

The summer sampling was to take place during the month of August, however, during the sampling it was found that a

considerable portion of the sampling at depths <7 m could not be taken by the grab method due to the predominance of rocks at the sampling location. All soft-substrate locations were sampled with Ekman grabs in August as planned. An alternate technique was sought for rocky bottoms, and the diver-operated dome sampling method was adopted. The remaining rocky substrates were thus resampled in October. Gale et al (1975) showed that dome samplers are effective over rocky substrates, thus it was hoped to overcome the bias that would have been introduced by using the Ekman grab which cannot sample rocky substrates. The possible variation in efficiency between the two techniques has not been determined, but is expected to be less than if only the Ekman grab had been used on both substrates. A more important bias was probably introduced by the difference in sampling dates, some summer taxa were undoubtedly lost in the October sampling. The significance of this loss is not known, and could not be assessed due the significant differences in taxonomic composition expected between the two substrate types. It should be noted that although some of the less abundant taxa could have been missed the more dominant taxa probably were not. In four northern Ontario lakes Vascotto (1976) found that the epilimnetic taxa tended to emerge continuously through the summer months, with at least two instars being present at all times. Hypolimnetic taxa, on the other hand would have been severely under-sampled in June and July.

The lack of replication, the small area sampled, and the relatively small number of organisms per sample, precluded the use of a rigorous statistical treatment. Of all organisms collected, 23 830 or 88% were members of the dipterans. Their numerical dominance, coupled with previous experience, led to the decision to emphasize this group. While there was insufficient information for the non dipteran taxa to do anything other than a presence/absence discussion, it was felt that a discussion based on relative abundance of numerically dominant dipterans was possible.

Non-Insect Benthos

Twenty-two (22) non-insect taxa were collected; most Tubificidae were collected at depths greater than 10 m. The 109 individuals which made up this group represented 8% of all organisms collected.

Oligochaeta

One hundred and twenty-nine Oligochaetes or portions thereof were collected. Of these 58% could only be identified to the family level. The 54 individuals identified to genus or species were members of eight taxa, and these were distributed over 22 sampling sites (Table 5-17).

TABLE 3-17

PRESENCE OF OLIGOCHAETES DURING AUGUST - OCTOBER

	Moose					Goose					Icy					Able					Slush				
Depth (m)	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
Tubificidae		X	X	X			X		X										X				X	X	
Naididae		X	X																				X		
Lumbriculidae																									
Limnodrilus hoffmeisteri																									
Nais spp	X			X													X						X		
Chaetogaster spp	X	X	X	X									X	X											
Stylaria fossularis			X																						
Vejdovskyella comata																									
Slavina appendiculata											X		X						X						
Dero spp											X														
Uncinais uncinata											X														

	Marmion Lake: South					Lower Below					North					Central					Anderson Bay				
Depth (m)	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
Tubificidae					X									X	X					X		X		X	X
Naididae							X														X				
Lumbriculidae		X																							
Limnodrilus hoffmeisteri																				X					
Nais spp	X				X				X		X						X					X			
Chaetogaster spp									X		X						X								
Stylaria fossularis									X			X													
Vejdovskyella comata									X																
Slavina appendiculata																					X	X			
Dero spp																					X		X	X	
Uncinais uncinata																									

TABLE 3-18

DISTRIBUTION OF MOLLUSCS IN ATIKOKAN STUDY DURING AUGUST AND OCTOBER

	Moose					Goose					Icy					Able					Slush				
Depth (m)	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
Physa spp																									
Amnicola limosa																									
A. grandis																									
Valvata tricarinata																									
Amnicola spp																									
Gyraulus parvus																									
Pisidium spp							X																		

	Marmion Lake: South					Lower Below					North					Central					Anderson Bay				
Depth (m)	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
Physa spp																						X			
Amnicola limosa								X														X			
A. grandis																		X							
Valvata tricarinata																X									
Amnicola spp												X													
Gyraulus parvus																									
Pisidium spp	X							X												X					X

TABLE 3-19

DISTRIBUTION OF AMPHIPODS IN ATIKOKAN STUDY DURING AUGUST AND OCTOBER

	Moose					Goose					Icy					Able					Slush				
Depth (m)	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
H. azteca											X					X	X								
Crangonyx sp																									
P. affinis																									

	Marmion Lake: South					Lower Below					North					Central					Anderson Bay				
Depth (m)	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
H. azteca		X						X				X									X				
Crangonyx sp		X													X										
P. affinis																									

Uncinais uncinata, *Chaetogaster spp*, *Stylaria fessularis*, and *Vejderskyella commata* were only collected over rocky substrates. Little among lakes variation in taxonomic composition was evident, the exception being the paucity of taxa (1) found in Snow Lake.

Mollusca

Twenty-four individuals from seven sites and representing seven mollusk taxa were collected, two were pelecypods *Anodonta grandis* and *Pisidium* spp, and the rest were gastropods (Table 5-18). Both pelecypods are ubiquitous and capable of surviving large pH ranges and lake types (Green 1971). They are common in the Great Lakes, shield lakes and even arctic lakes. *A. grandis* is one of the few unionid clams which can be reliably collected in pre-Cambrian Shield lakes, although, due to the soft water there, their shells are often quite thin (Vascotto and Green, unpublished data). In these samples, *A. grandis* was only collected in Marmion Lake Central; however, they probably occur in most other Marmion Lake regions. This pelecypod is quite large, and hence difficult to sample reliably with a small remote sampler such as an Ekman grab.

The small sphaeriid clam *Pisidium* is generally found in soft sediments at most depths (Green 1971, Vascotto 1976). Factors affecting their distribution, other than the presence of fine sediments, are not known. In these collections they were only found in Snow Lake, and most of the Marmion Lake sampling sites.

The five gastropod taxa were collected only at the Marmion Lake sites and in association with soft sediments. The exception was *Valvata tricarinata* collected in a Marmion Lake Central sample over a rocky substrate. This species has been described as being found over organic and inorganic materials of the littoral zone (Harman 1972). The gastropods in the Marmion Lake collections are typical of what one would expect to find in a lake having abundant vegetative growth along the shore. These snails are typically grazers, feeding on epilithic and epiphytic algae, and dead and decaying matter (Pennak 1953). They thrive on submerged or emergent vegetation beds which have large surfaces for algae growth, and are usually found in low numbers over bare substrate. The taxa collected here are described as inhabiting autochthonous organic matter, aquatic plants and their decaying remains (Harman 1972). Hence the diversity and abundance found in Marmion Lake, and paucity in the other lakes conform to the expected when one considers the shoreline development index and aquatic vegetation present.

Amphipoda

Only three amphipod species were collected, *Hyalella azteca*, *Crangonyx* sp, and *Pontoporeia affinis*, (Table 5-19). *Hyalella azteca* was the most widespread, being collected at most shallow water sites. The littoral amphipods have often been considered important fish food items in a variety of environments, and have been the subject of a number of detailed studies (Gerking 1962, Patrick et al 1983). *Crangonyx* sp was only present in one sample at Marmion Lake South, and *Pontoporeia affinis* is the only one of the three amphipods that can be used as a reliable indicator of environmental conditions. The glacial relict, *Pontoporeia affinis*, is only found in cool oxygenated waters and sediment of small particle sizes in which the amphipod burrows. Generally *Pontoporeia affinis* is considered an indicator of mesotrophic conditions (Brinkhurst 1974; Segestrale 1962). Although usually found only in cool deep waters, as one moves northward one finds *Pontoporeia affinis* in abundance in shallow artic ponds having eutrophic characteristics (Brunskill, et al 1973). Its apparent limited distribution in the study area probably reflects the marginal suitability of the environment as shown by the low oxygen content of hypolimnetic waters.

Non-Dipteran Insects

Ephemeroptera

Mayflies have a widespread distribution occurring in all types of fresh water having sufficient oxygen. The principal factors which seem to govern the presence of individuals are depth, oxygen, substrate and water currents. The greatest diversity of mayflies is found in lotic environments, but a number of species are common in lakes to a depth of 15 m. Typically riverine species have also been found in shallow wave-swept shores of lakes (Burks 1953). Mayflies are typically vegetable feeders, occasionally feeding on dead insects (Pennak 1953).

Hexagenia limbata, a burrowing mayfly, has been characterized as inhabiting reservoirs, large rivers and lakes (Burks 1953). *Caenis simulans*, a sprawling type mayfly has also been found associated with reservoirs, while other members of the genus are typically found in ponds and semi-stagnant pools. *Leptophlebia* is reported occurring in pools of rivers and ponds.

Paraleptophlebia, *Heptagenia* and *Stenonema* are species characteristic of running waters and wave swept shores which were found in these collections at Atikokan. Six genera of mayfly and an unidentified member of the Heptageniidae were present in the collections (Table 5-20). The burrowing mayfly *Hexagenia limbata* displayed the broadest distribution, being collected in

TABLE 3-20

DISTRIBUTION OF INSECTS (NON-DIPTERANS) IN THE AT[illegible]MAN COLLECTIONS DURING AUGUST AND OCTOBER

Depth (m)	Moose					Beaver					Icy					Abie					Slash				
	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
Ephemeroptera																									
B. lineola			X				X	X																	
S. (bumpstalis)																									
Caenis spp																							X		
Paraleptophlebia													4										X		
Heptageniidae																							X		
Leptophlebia spp																									
Stenonema																									
tripunctatum																									
[illegible] Odonata																									
Coenagrionidae																									
Aeshnidae																									
Neuroptera																									
Sialis spp							X																		
Trichoptera																									
Leptoceridae																									
Phylocentropus spp																									
Neureclipsis spp																									
Mystacides																									
sepulchralis																									
[illegible]																									

Depth (m)	Harrison Lake																								
	South					Lower Selan					North					Central					Anderson Bay				
	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10	1	3	5	7	≥10
Ephemeroptera																									
B. lineola								X				X		X				X	X		X	X	X	X	
S. (bumpstalis)																					X				
Caenis spp							X														X				
Paraleptophlebia		X																							
Heptageniidae																									
Leptophlebia spp		X																							
Stenonema		X																							
tripunctatum																									
[illegible] Odonata																									
Coenagrionidae																						X			
Aeshnidae		X																							
Neuroptera																									
Sialis spp								X				X						X	X	X					
Trichoptera																									
Leptoceridae												X													
Phylocentropus spp		X						X																	
Neureclipsis spp		X																							
Mystacides																									
sepulchralis																									
[illegible]																									

Moose, Snow, and all Marmion Lake transects. It should be noted that this species, because of its normally high densities, is often considered an important source of fish food in a variety of lakes and streams (Coker 1968). *Hexagenia limbata* also had the most diverse depth distribution ranging in collections from 1 to 7 m.

Most of the other mayfly taxa were collected mainly from the 3 and 5 m contours of the Marmion Lake basin and belong to genera characteristic of lotic systems. The shallowness of their distribution probably reflected the requirement of moving water for their survival; this could be satisfactorily met by a relatively wide basin allowing for good wind fetch and wave action.

Odonata

Both of the two families of nymphs collected, the Aeshnidae and Coenagrionidae, can be roughly classified as climbers and are usually associated with dense vegetation or woody trash in still waters (Pennak 1953). Generally these families are found in unpolluted waters. In these collections, they were found at Anderson Dam and Marmion Lake South, but probably were reasonably abundant at most other weedy sampling transects.

Megaloptera

The dobson fly (hellgrammite) *Sialis* sp was the only megalopteran collected, having been found in Snow Lake, and all Marmion Lake transects. *Sialis* is a widespread genus and probably occurs in all the lakes sampled but is most abundant in Marmion. This predatory larvae is typically associated with soft substrates, where it may burrow, or aquatic vegetation such as *Phragmites* stands (Ward and Whipple 1966).

Trichoptera

Six caddisflies were collected from four locations in the Marmion Lake watershed only. Two families were represented, Leptoceridae, and Psychomyidae. The genera found (Table 5-20) are all common to glacial lakes and require a good oxygen supply (Ross 1944) hence they tend to be found in shallow, well oxygenated, windswept shores of lakes. They were never collected deeper than 5 m.

Diptera

By far the largest variety of taxa collected belong to the diptera. Most of the taxa belong to the family Chironomidae. Chironomidae distribution is known to be affected primarily by substrate composition, availability of oxygen, trophic status of

the lake, and food available. Vascotto (1976) was able to show that in Laurentian Shield Lakes, the greatest difference in taxonomic composition existed between samples collected in the phototrophic and those in the profundal zone. These differences observed within lakes were greater than observed differences at depth among lakes whose basins were in different geologic formations (ie, limestone versus granite).

Cursory observations of the data matrix generated from the August and October collections revealed no obvious among-or within-lake trends. This was expected because of the variety of species, substrates, depths, and vegetation present which varied both among and within lakes.

Since for the greater part of the summer, the top of the thermocline was found between the 5 to 7 m depth, the data set was split into samples collected in the 0 to 5 m depths and hence referred to as littoral, and those collected at depths 7 m or greater and hence referred to as profundal.

The littoral taxonomic composition would be expected to be closely related to substrate type, vegetation; shelter from wind and local physical variables and hence would be highly variable. The profundal composition would be expected to reflect the trophic status of the basin.

Littoral Diptera

Fifty-two dipteran taxa were collected in the 1 to 5 m depths in August and October (Table 5-21). The collections richest in taxa were from the Anderson Dam transect (20 taxa) and Snow Lake (21 taxa). The lowest number of taxa collected were on the Marmion Central transect where only 8 taxa were found. Casual observations of the data matrix did not reveal any obvious depth or among lakes distributional patterns.

The data was hierarchically ordered to facilitate interpretation using the Mutual Information Statistic (Orloci 1968, 1969). This technique orders the samples relative to their similarity of taxonomic composition. Samples are fused together into groups based on the principal of information (similarity of composition) shared between successive cumulative pairings. The results obtained are then presented as a dendogram (Figure 5-24), in which individual samples are listed along the horizontal axis, while the vertical distance at which two samples are joined reflect the degree of similarity (as per mutual information statistic). The closer that the junction is to the horizontal axis the greater the similarity among samples. Major clusters of samples represent "groups of samples", which may be referred to as assemblages. Three major groups were formed

TABLE 5-21.

DIPTERAN TAXONOMIC LIST FOR 1 - 5 m DEPTHS
COLLECTED AT ATIKOKAN, AUGUST - OCTOBER, 1981

Percent composition of species in total sample, listed in descending order of percent values:

SPECIES	PERCENT	FREQUENCY (# OF SAMPLES)
Tanytarsus sp 1	24.68	7
Procladius spp	14.75	11
Chironomini	14.24	2
Cladopelma spp	5.02	4
Einfeldia spp	4.80	7
Ceratopogonidae	3.81	7
Chaoborus punctipinnis	3.69	5
Psectrocladius spp	2.90	2
Dicrotendipes spp	2.36	4
Chironomus spp	1.95	5
Tanytarsus sp 2	1.93	3
Dero spp	1.77	5
Microtendipes spp	1.70	5
Phaenopsectra spp	1.49	5
Heterotrissocladius cf c	1.23	2
Chaoborus flavicans	1.19	4
Paralauterborniella spp	1.05	1
Ablabesmyia spp	1.04	5
Orthocladiinae	0.97	3
Parachironomus T1	0.94	5
Micropsectra spp	0.76	3
Cricotopus (isocladius)	0.66	3
Cricotopus (cricotopus)	0.66	3
Coelotanypus spp	0.66	4
Cryptotendipes spp	0.63	2
Cryptochironomus spp	0.53	1
Ablabesmyia T2	0.37	3
Ablabesmyia annulata	0.35	1
Paratanytarsus sp 1	0.35	1
Polypedilum spp	0.35	1
Lauterborniella spp	0.28	2
Glyptotendipes spp	0.26	2
Cladotanytarsus spp	0.26	1
Zalutschia nr obsepta	0.26	1
Chironomus (thummi) grou	0.19	1
Ablabesmyia T3	0.18	1
Polypedilum (ss) spp	0.18	1
Tanypus spp	0.18	1
Pseudochironomus spp	0.18	1
Pseudochironomus nr arT1	0.18	1
Psectrocladius T3	0.09	1
Synorthocladius spp	0.09	1
Tanytarsini	0.09	1
Thienemanniella spp	0.09	1
Parakiefferiella spp	0.09	1
Parachironomus T9	0.09	1
Epoicocladius nr flavens	0.09	1
Nanocladius spp	0.09	1
Chironomus (salinarius)	0.09	1
Chironomus (plumosus) gr	0.09	1
Cricotopus spp	0.09	1
Demicryptochironomus spp	0.09	1

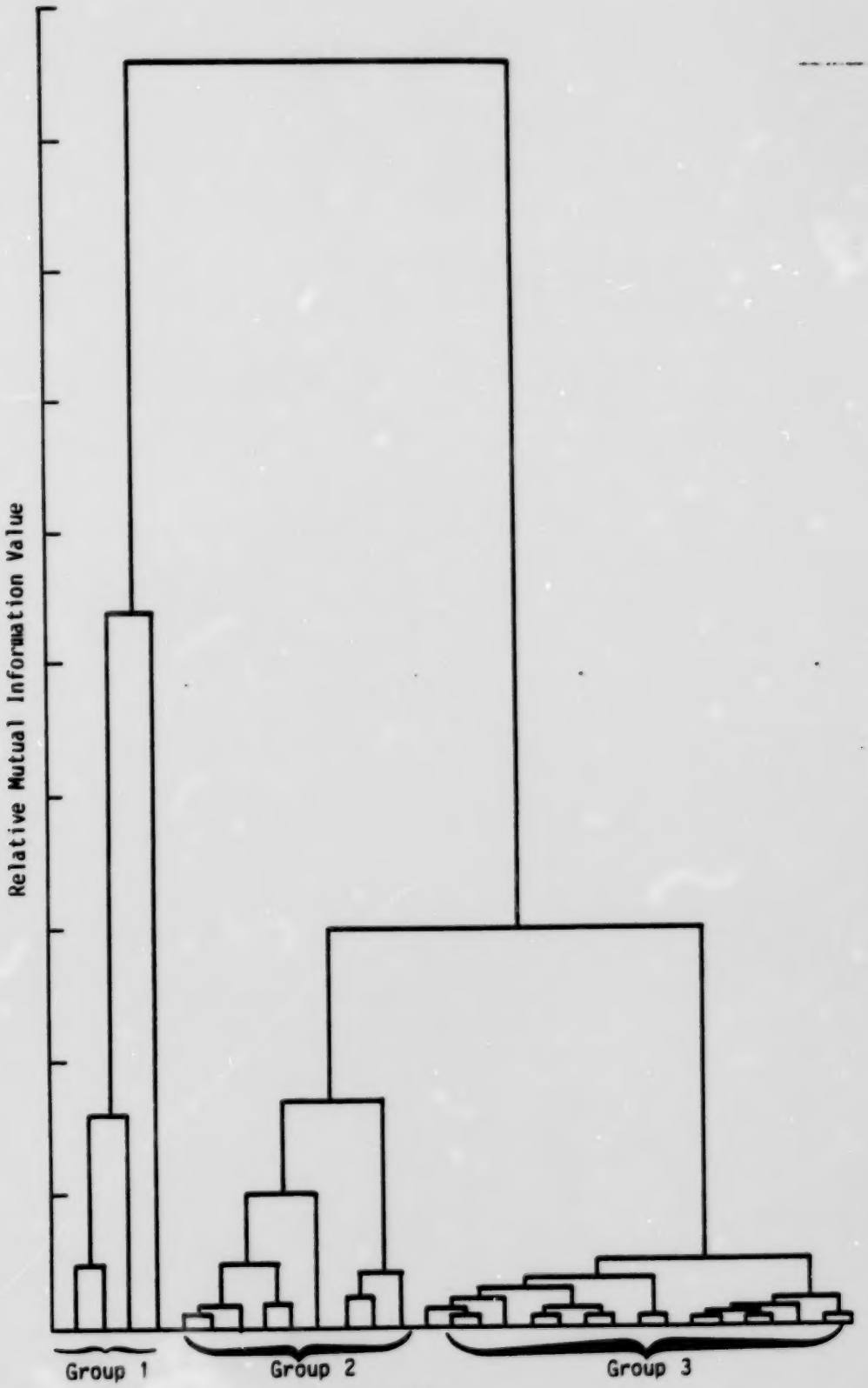


FIGURE 5-24

ORDINATION DENDOGRAM OF ALL SAMPLES 3-5 m DEPTH
COLLECTED DURING AUGUST AND OCTOBER AT ATIKOKAN
ONLY DIPTERAN TAXA REPRESENTED

160273 RD

(Figure 5-24). The distribution of the samples into groups are summarized in Table 5-22. The samples which made up group I were all collected from soft bottom at 3 to 5 m depths, of Snow and Slush Lakes except for one sample from Marmion Central. Although these samples came from relatively soft substrate, the bottom was more gravelly than silty or sandy. The taxa present in the samples reflected the substrate quality; *Tanytarsus* sp 1, a taxa collected mainly in coarse substrate was abundant, as well as the ubiquitous predatory *Procladius* spp, a genus which was very abundant in all soft substrate samples (Table 5-22).

TABLE 5-22

PERCENT TAXONOMIC COMPOSITION
OF THE LITTORAL DIPTERAN GROUPS

	GROUP I	GROUP II	GROUP III
Tanytarsus sp1	40.6	2.7	0
Procladius spp	26.4	18.7	0
Tanytarsus sp2	1.6	1.9	48.6
Ceratopogonidae	7.2	0.3	0
Einfeldia spp	3.4	0.5	3.6
Phaenopsectra (tribelos) spp	0.0	14.0	0.2
Distribution	Soft bottom from 5 m depths	Mainly Marmion soft bottom sites	Rock Bottom sites mainly away from Marmion Lake mostly 1-3 m depths

Group II was composed of samples only from soft bottom samples (silt and sand areas). All the samples in this group were collected in Marmion Lake, and were characterized by high densities of the genus *Procladius*. Those samples coming from highly reduced sediments were characterized also by the presence of *Phaenopsectra (tribelos)* spp, but not *Phaenopsectra coracina*, a taxa commonly found under low oxygen conditions (Curry 1965, Vascotto 1976).

Group III was made up strictly of samples collected from rocky substrates, irrespective of location. There was considerable similarity among samples and all had a low diversity of species, especially chironomids. The only taxon present in reasonable amounts was *Tanytarsus* sp 2, and this taxon can be considered a good indicator of rocky substrate.

In summary, the littoral chronomid composition did not allow for differentiation between lakes, with the greatest variation occurring between substrate types.

Profundal Diptera

As one would expect, there was a decline in the numbers of taxa collected in the hypolimnetic zone (29) compared to the littoral (Table 5-23). While the littoral diptera consisted of a large number of genera, most of the hypolimnetic taxa collected belonged to the characteristic taxa of shield lakes *(Chironomus, Procladius, Tanytarsus, Phaenopsectra* and *Chaoborus)*.

The lowest number of taxa were collected in Slush Lake (2), and the largest in Marmion Lake North (12). No clear pattern in species richness was evident between the Marmion Lake and smaller lakes sites.

The only anomalous collection (ie, relatively conspicuous by its difference of taxonomic composition) was found in Moose Lake, where taxa usually considered littoral were found *(Dicrotendipes, Paratanytarsus,* and *Cladotanytarsus)*. This aberrant composition may be due to the drawdown of Moose Lake which probably resulted in a redistribution of taxa along some very steep shorelines.

The hypolimnetic faunal collections were ordered on the basis of similarity using MIA. The schematic results are presented in Figure 5-25. The samples first branched into two major groupings: 1) samples exclusively from Marmion Lake, and 2) a group mostly of other samples. All of the Marmion Lake samples in the first branch were collected from soft bottoms, and the dipteran collections were heavily dominated by the phantom midges *Chaoborus punctipinnis*, and *Chaoborus flavicans* (Table 5-24). Both organisms are typical of the hypolimnetic zone of lakes in this region which undergo severe periodic oxygen depletion (Vascotto 1976). The samples were very species-poor, with few individuals of the genera *Procladius* and *Chironomus (Thummi gr)* occasionally being found. All of the above can tolerate low oxygen concentrations. It is noteworthy that the oxygen concentrations measured in the vicinity of the sampling locations in the months of August and September ranged between 0 and 2 ppm.

TABLE 5-23

DIPTERAN TAXONOMIC LIST FROM DEPTHS GREATER THAN 5 m
COLLECTED AT ATIKOKAN DURING AUGUST - OCTOBER 1981

Percent composition of species in total sample, listed in descending order of percent values:

SPECIES	PERCENT	FREQUENCY (# OF SAMPLES)
Chaoborus punctipenis	43.19	16
Chaoborus flavicans	12.90	10
Procladius spp	10.03	10
Chironomus spp	4.44	6
Chironomus (plumosus) gr	4.30	3
Tanytarsus sp 2	3.44	4
Chironomus (thummi) gr	2.44	5
Ablabesmyia spp	2.17	5
Cricotopus (cricotopus)	2.17	4
Phaenopsectra spp	2.01	2
Tanytarsus spp	1.86	1
Chironomini	1.55	3
Chironomus (salinarius)	1.15	2
Tanytarsus sp 1	1.15	2
Chironomus (anthracinus)	1.15	3
Dicrotendipes spp	0.62	2
Lauterborniella spp	0.62	1
Nanocladius spp	0.57	1
Micropsectra spp	0.45	2
Zalutschia nr obsepta	0.43	1
Microtendipes spp	0.31	1
Parachironomus T1	0.31	1
Orthocladiinae	0.31	1
Einfeldia spp	0.31	1
Cricotopus spp	0.31	1
Cricotopus (isocladius)	0.31	1
Ceratopogonidae	0.29	1
Psectrocladius spp	0.29	1
Cryptochironomus spp	0.14	1

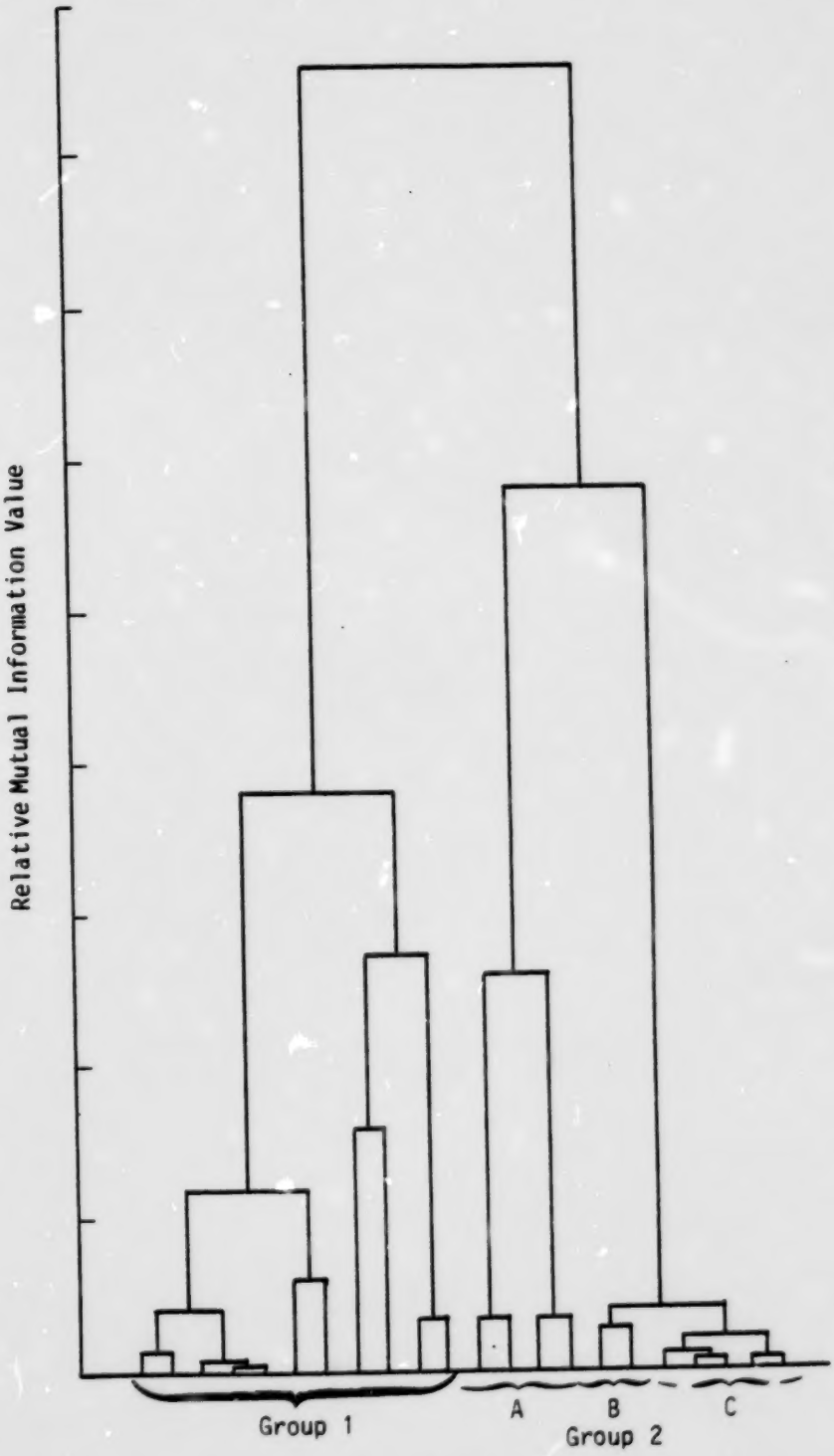


FIGURE 5-25

ORDINATION DENDOGRAM OF ALL SAMPLES COLLECTED AT 7 m AND DEEPER IN AUGUST AND OCTOBER AT ATIKOKAN (ONLY DIPTERAN TAXA REPRESENTED)

160270 RD

TABLE 5-24

PERCENT TAXONOMIC COMPOSITION
OF PROFUNDAL DIPTERAN GROUPS

	GROUPS			
	1	2		
		A	B	C
Chaoborus punctipinnis	47.2	32.9	0	0
Chaoborus flavicans	8.0	19.0	0	0
Procladius spp	16.0	0.4	0	0
Tanytarsus sp 2	3.0	0,8	0	77.0
Chironomus spp	4.0	6.7	0	0
Chironomus (plumosus) gr	0	14.2	0	0
Chironomus (thummi) gr	4.2	0	0	0
Distribution	mostly Marmion 7-20 m depth soft bottom	mostly small lakes low oxygen soft sub-strates	Moose & Slush Lake anoxic soft sediment	All small lakes rocky sub-strates 7 m

The two *chaoborus* species can diurnally move out of the anoxic zones. *C. punctipinnis*, the most tolerant of the two species, represented 75% of all organisms collected in the samples from very low oxygen zones such as Anderson Dam, Marmion North, Lower Seine, and Marmion South at depths greater than 7 m. The other major group of samples consisting almost exclusively of non-Marmion Lake sites, could be broken down into three recognizable categories:

(A) soft bottom with low oxygen
(B) deep soft bottom sites with complete oxygen depletion
(C) seven metre depths from rocky substrates.

Category A was characterized by the presence of *C. punctipinnis*, *C. flavicans*, and *Chironomus (plumosus) gr*.

Category B had no living organisms and came from complete anoxic conditions in Moose Lake and Slush Lake.

Category C was characterized by a dearth of taxa, usually characterized by the presence of members of the genus *Tanytarsus*, and predominantly *Tanytarsus* sp 2. The presence of these taxa can be taken to indicate the presence of coarse substrate (rocky), in oxygenated waters. Vascotto (1976) speculated that the presence of this taxa indicated presence of algae remains on which they graze.

With the exception of the Lower Seine August collections, all samples present in this category were collected at 7 m on rocky substrates from the chain of lakes south of Marmion Lake. With the exception of Slush Lake, the profundal chironomid fauna clearly typifies these lakes as members of the dystrophic type according to Thienemann in Berg (1938), that is, brown water lakes, having low productivity, extreme hypolimnetic oxygen depletion, and gyttja bottom. The predominant role played by *Chaoborus* and *Chironomus* support this. Slush Lake may more closely approximate the oligotrophic conditions as shown by the low number of *Chaoborus*, and the relative abundance of *Tanytarsus*. These findings reinforce the chemical data which showed very low nutrients, suspended solids and conductivity in Slush Lake.

Spatial Variation in Benthic Taxa - Winter Sampling

The analysis of benthic samples to determine distributions and density of taxa in lakes present serious technical problems. The most common parameter used are comparisons of density of organisms collected. This involves straightforward parametric statistical tests to determine if differences in densities between locations or times are significant. Because the distribution of benthic organisms is extremely patchy, and samples are often composed of dozens of taxa, the total numbers are not necessarily good indicators of environmental quality. Sometimes the high densities are due to heavy representation by environmentally undesirable taxa such as *Tubifex tubifex* which would not be apparent in the total number of organisms in a sample. Hence the value of such analyses is questionable.

To partially overcome these deficiencies and the problem of dealing with numerous taxa, a common practice is to divide the collection into taxonomic groups at the family or order level and compare densities within taxonomic units. However, it is well known that most of the identifiable environmental responses of organisms are discriminated at the species or genus level. Moreover, within a family, organisms capable of surviving conditions spanning all environments are found. For example, in the Chironomidae, *Chironomus plumosus* can live in polluted anoxic waters while members of *Heterotrissocladius* are considered excellent indicators of oligotrophic conditions (Saether 1975).

Another common approach has been to use the data collected in a series of similarity analyses using presence and absence data. This has been a powerful tool in the search of indicator taxa. There are some problems associated with these techniques also: (a) one must assume that the number of replicates used was adequate for reasonably sampling taxa having low densities; (b) since all taxa are weighed equally, numerically dominant taxa are not identified and if these are an important fish food one has no indication of change in abundance; furthermore, changes among dominants may indicate environmental change.

In the late 1960's and early 1970's diversity indices came into vogue. These generally were meant to measure the evenness of the taxa densities in a sample, and the value obtained was purported to be a measure of environmental "health". However, this approach was successfully criticized by Hurlbert (1971) and many others and is now seldom, if ever, used by the scientific community.

Ontario Hydro has been using a classification technique which uses Orloci's (1967, 1969) information statistic to order the samples. This technique is sensitive to taxonomic composition as well as the relative density of each taxon. However, the statistic is most heavily influenced by the organisms which are numerically dominant, and almost ignores the rare species (the ones which are most likely to be used as indicators). Another flaw of this technique is that the statistic is insensitive to samples containing low numbers of organisms.

The mutual information analysis was chosen for the late summer sample. Before attempting to work the data further, an attempt was made to identify some of the statistical limitations of the data, and to try and understand the distribution of the standing crop and the reliability of the samples collected, to determine variation within and among lakes. For this purpose in February 1982 three replicate samples were collected by means of a 15 cm Ekman dredge. It was understood at the start that three replicates may not be adequate, but financial constraints and the size of the study precluded expansion. All accessible points were sampled (Table 5-25). The data collected is tabled in Appendix 8.

Since only soft substrates were sampled, and the bulk of the organisms sampled were dipterans, the following analysis will deal exclusively with this group.

TABLE 5-25

AREAS SAMPLED BY EKMAN DURING FEBRUARY COLLECTIONS

Depth	House L.	Snow L.	Icy L.	Able L.	Slush L.	Marmion South	Lower Seine	Marmion Central	Marmion North	Anderson Dam
3 m		X				X				X
7 m	X			X		X		X		X
8 m		X	X				X			
10 m			X	X				X		X
11 m						X				
13 m					X				X	
14 m							X			
20 m										
30 m	X									

Distribution of Dipteran Insects

The spatial distribution of dipteran standing crop is illustrated in Figure 5-26. Considerable variation among replicates was found, with the coefficient of variation ranging between 0.14 and 1.75, with 60% of the locations having a coefficient of variation greater than 0.50. Such high variations greatly weaken the value of any statistical comparisons. Very few trends were apparent in the data, except that Moose Lake samples contained very few organisms compared to the other sites. The maximum density of organisms appeared to reside in the 10 to 17 m zone sampled, which in most cases was the maximum depth sampled. These results were unexpected because usually the patterns are reversed with maximum numbers occurring in the top 10 m (Brinkhurst 1974; Vascotto 1976). Among lakes and/or watersheds no clear trends were evident except for Moose Lake mentioned above.

Distribution of Numbers of Taxa

The distribution of the number of dipteran taxa are presented in Figure 5-27. The numbers collected ranged from 0 to 11 per sample, with mean values ranging from 1 to 8 per sampling site. The mean values of Marmion Lake and non-Marmion Lake sampling sites were statistically tested and found not to be significantly different at the 95% level. No trends were visible either among lakes or within lakes. The possible exception was Moose Lake which at both depths sampled had very low numbers of taxa.

The possibility of seeking out indicator chironomids was considered. Such an approach would be possible if one could assume that the three replicates at each site were representative of most of the taxa in the area. To determine whether the three replicates were adequate, the samples were stratified by depth groupings (as in the previous Figures) and by principal watersheds (ie, small lakes versus Marmion Lake). The percent represented by each replicate to the total number of taxa collected at each location was plotted (Figure 5-28). The order in which the identification laboratory processed the samples was used in the plots. The underlying hypothesis is that if most species present in the area are found the curve will be past the upper inflection point and essentially level off. The range of curves found at each group of sampling locations are illustrated in Figure 5-28. In the opinion of this investigator the only area which was adequately sampled to identify the "rare" species which are typically used as indicator chironomids was the 10 to 16 m depth of Marmion Lake. The 3 m zone in both major watersheds, as well as all depths in the smaller lakes were clearly under-sampled to identify all or most dipteran taxa in the area. Below 3 m depth in Marmion Lake the taxa were relatively well sampled.

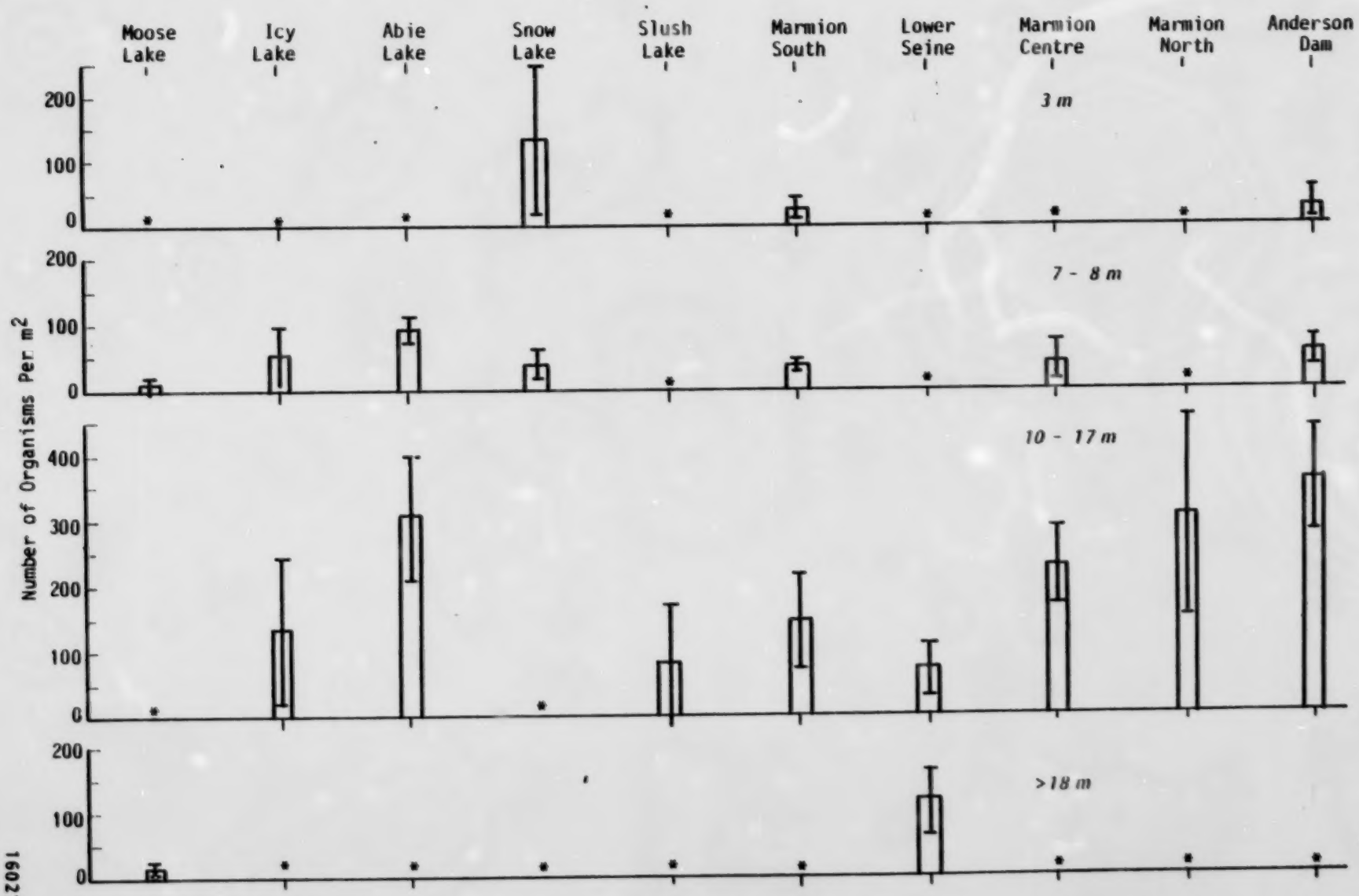


FIGURE 5-26

THE BENTHIC STANDING CROP DISTRIBUTION OF WINTER DIPTERAN COLLECTION AT ATIKOKAN (MEAN n/m^2 AND S.D. SHOWN * - NO SAMPLE)

160272 RD

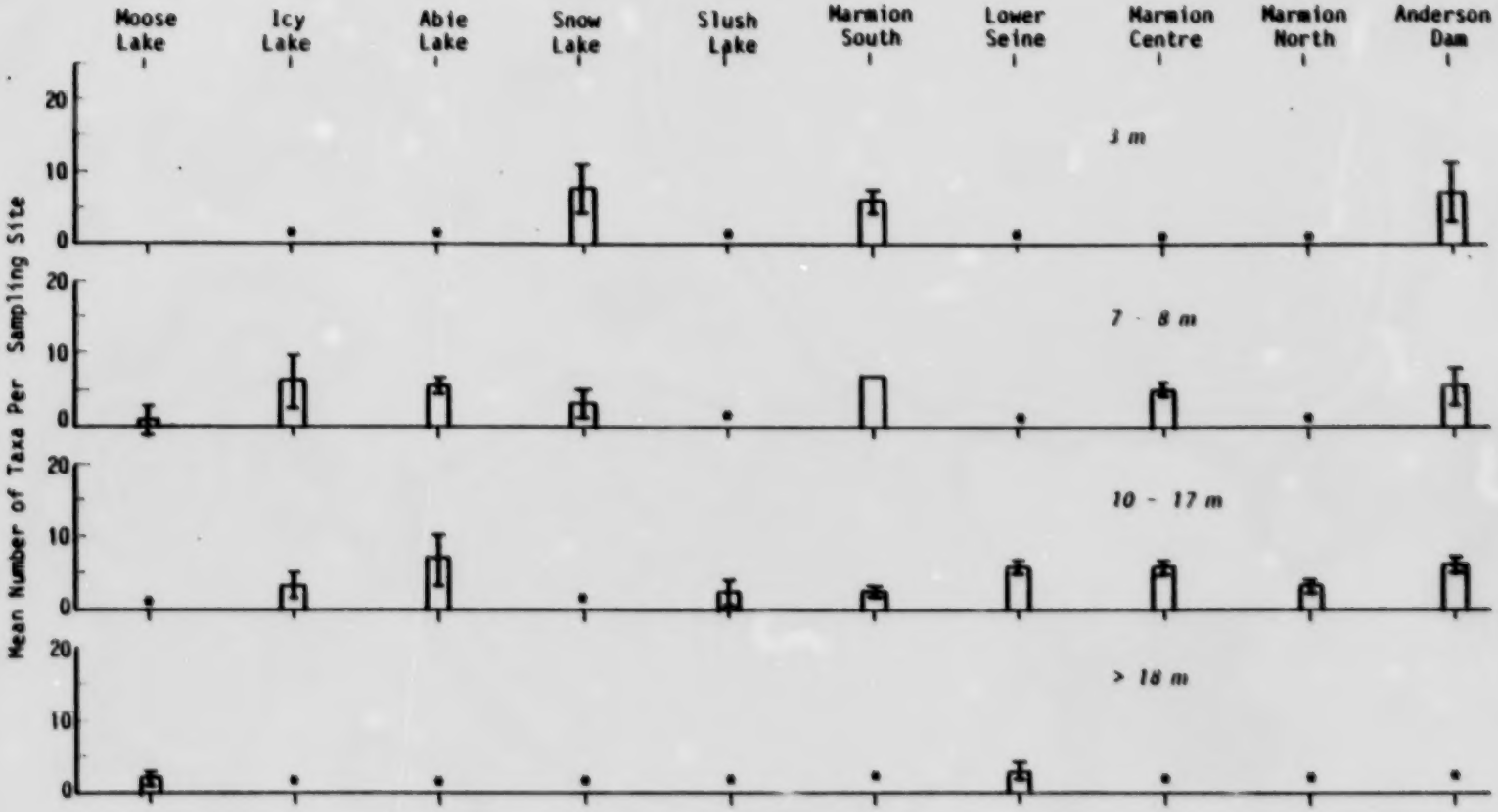


FIGURE 5-27

MEAN NUMBER OF DIPTERAN TAXA COLLECTED DURING WINTER SAMPLING AT ATIKOKAN (MEAN n/m² AND S.D. SHOWN * - NO SAMPLE)

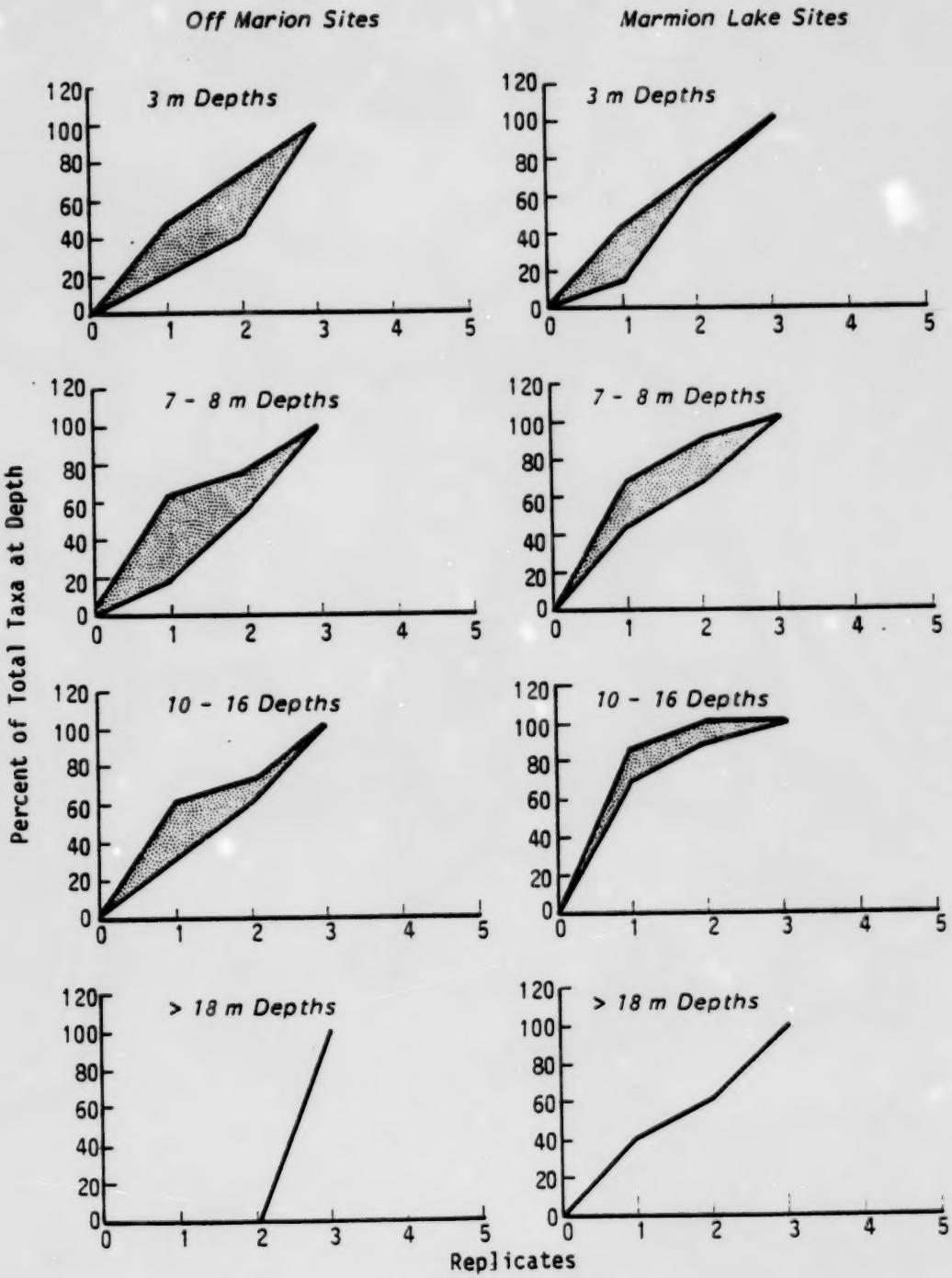


FIGURE 5-28

PERCENT OF TOTAL TAXA COLLECTED AT A SITE ON EACH SUCCESSIVE REPLICATE. UPPER LINE REPRESENTS "BEST" AND LOWER LINE "WORST" CASE SITUATIONS

The difference in the shape of the curves between the Marmion Lake sampling sites and those in the upper lakes is interpreted as an indication of a more heterogeneous distribution of groups of organisms in the sites off Marmion Lake. This heterogeneity is probably a reflection of a more variable environment. The Marmion Lake bottom, with extensive rooted vegetation beds set in expanses of soft substrate, represent a more homogeneous environment, within the substrate that could be sampled by Ekman grab, while the smaller lakes, with steep depth gradients, exposed bedrock with silt pockets, and occasional vegetation, represents a more heterogeneous environment supporting diverse faunal assemblages. Luckily, those taxa which account for over 90% of the overall standing crop seem to be well sampled, being present in virtually all samples, and only rare species are missing.

The winter sampling resulted in the collection of considerably fewer dipteran taxa than in August, a reduction from 54 to 38 (Table 5-26). This occurred in spite of the fact that the August collection consisted of half as many samples as the February collection. The reduction in taxa is probably the result of seasonal life patterns, where individual taxa are either overwintering in the egg stage or in the motile first instar. In spite of the reduction in taxa found in winter, only two of the more numerous taxa collected in August were missing; these were *Einfeldia* and *Dicrotendipes*. The other missing taxa were individuals collected in low numbers and in few samples in August (ie, rare taxa).

Synthesis of Benthic Results

The ten transects which were sampled appear to fall into three distinct categories of fauna, Marmion Lake type, Moose Lake and the smaller shield lake types in the Atikokan circuit. The degree of variation between the three categories seemed to differ according to such variables as depth, substrate and amount of dissolved oxygen.

Vascotto (1976) found that the benthic fauna of small central Canadian lakes could be divided into two basic faunal assemblages: those characteristic of the photogenic and those characteristic of the profundal zone. The depth of the photogenic zone can be roughly estimated as extending from the surface to twice the secchi depths. In these lakes the limit of the photogenic zone or compensation point should be reached between 5 and 7 m depths, and any sample collected shallower than 7 m was considered as being part of the littoral zone. The littoral zone was richer in taxa than the profundal, consistent with studies in most lakes (Brinkurst 1974). This enrichment in taxa was evident for all groups of organisms collected, but was particularly marked for the non-dipteran insects.

TABLE 5-26

COMPOSITION OF FEBRUARY COLLECTIONS FROM SOFT BOTTOM

Percent composition of species in total sample, listed in descending order of percent values:

SPECIES	PERCENT	FREQUENCY (# OF SAMPLES)
Chaoborus punctipinnis	53.10	44
Chaoborus flavicans	12.30	42
Chironomus (salinarius)	8.04	14
Chironomus (plumosus) gr	7.42	26
Procladius spp	5.70	42
Tanytarsus sp 1	5.60	26
Chironomus (thummi) gr	3.43	24
Cladopelma spp	0.91	7
Tanytarsus sp 2	0.76	6
Chironomus (anthracinus)	0.61	7
Chironomus spp	0.57	11
Heterotrissocladius cf c	0.29	7
Psectrocladius spp	0.20	2
Ceratopogonidae	0.10	4
Ablabesmyia T5	0.10	1
Ablabesmyia T3	0.10	4
Ablabesmyia annulata	0.10	3
Psectrocladius nr simula	0.09	4
Phaenopsectra (tribelos)	0.07	4
Zalutschia nr obsepta	0.06	2
Epoicocladius nr flavens	0.06	2
Larsia spp	0.04	1
Cladotanytarsus spp	0.04	3
Tanypus spp	0.04	2
Simuliidae	0.04	2
Paracladopelma undine	0.03	2
Parachironomus T1	0.03	2
Orthocladiinae	0.01	1
Endochironomus spp	0.01	1
Diplocladius nr cultrige	0.01	1
Labrundinia nr neopilose	0.01	1
Coelotanypus spp	0.01	1
Cryptotendipes sp 2	0.01	1
Phaenopsectra (ss) spp	0.01	1
Protanypus spp	0.01	1
Ablabesmyia T2	0.01	1
Ablabesmyia spp	0.01	1

The littoral zone of the small lakes in the cooling circuit supported faunas typical of shield lakes as evidenced by the data reported by Hamilton (1971) and Vascotto (1976). The rocky substrates were species-poor, and characterized by the grazer *Tanytarsus* sp 2.

The littoral zone of Marmion Lake contained an extensive complement of chironomids, some of which *(Phanenopsectra, Chironomus* and *Einfeldia)* are usually associated with highly organic, reduced sediments. In addition, the non-dipteran littoral fauna of Marmion Lake was very diverse. Ephemeropterans, Trichopterans, Amphipods, and Gastropods were collected on almost every transect. Many of the taxa collected are reported to inhabit sediments containing much autochthonous organic material and attached vegetation. Some of the insects collected were probably associated with the extensive beds of vegetation growing in the many shallow bays of Marmion Lake. However, our study shows that the vegetation seldom extends below the 3 m contour, so one must conclude that the littoral benthic fauna found was probably dependent on the autochthonous material resulting from the flooding of the basin, and in fact several of the Ephemeropterans collected have also been found in reservoirs (Burks 1953), and some of the gastropods are commonly found in rich shallow lakes.

In the profundal zone the benthic fauna of all the basins was strongly dominated by the Chironomidae. The taxa collected were typical of the region, and conformed closely to the findings of Hamilton (1971), and Vascotto (1976) for lakes near Kenora, Ontario, and for 25 lakes in the vicinity of Sudbury (report in preparation). Moose Lake was unique in that there was a real paucity of both taxa and absolute numbers. Most likely this phenomenon is due to the large drawdown of the lake which constricted the basin, and probably resulted in severe depletion of the benthic fauna by the trapped fish.

The small lakes in the circuit all bore characteristics of dystrophic-mesotrophic lakes, with the fauna being dominated by *Chaoborus-Chironomus* groups. Marmion exhibited more eutrophic characteristics as indicated by the predominance of *Chaoborus* . All of the profundal zones sampled were colonized by organisms capable of surviving under adverse low oxygen conditions, and were highly adaptable organisms (Curry 1965).

5.2.6 Fish

Larval Fish

The results of larval tows are in Appendix 9. There were 1,292 larval fish collected between May 11 and July 29, 1982. Yellow

perch was the most common (65%) of the nine taxa collected (Table 5-27). Iowa darter (29%) was also relatively abundant. Only one walleye and one lake whitefish were collected.

The lack of abundance or absence of particular species such as walleye, pike and lake whitefish may be related to the date of the initial collection and habitats sampled (for example lake whitefish may have hatched earlier than the initial collection period and moved into habitats that were not sampled. Similarly pike may not have been vulnerable to collection in surface tows as they are usually associated with macrophytes or other covers).

Yellow perch and Iowa darter were collected at all sampling locations (Table 5-27). Unidentified cyprinids were collected at all locations except Snow Lake, Marmion Lake Central, North and Anderson Dam while pumpkinseed were collected only in Icy and Abie Lakes.

The temperature range and dates during which each species was present in the catch is presented in Figure 5-29. Yellow perch, burbot and lake whitefish were collected during the first sampling period (May 11-13) and may have been present in catchable densities prior to those dates while Iowa darter, cyprinids, and pumpkinseed were present during the last sampling period (July 21-29) and may similarly have been catchable after those dates. The dates during which the larval fish were caught were consistent with spawning dates cited by Scott and Crossman (1973) with the exception of logperch which appeared earlier than the June date cited.

A comparison of larval yellow perch densities in the upper lakes (Snow, Icy, Abie and Fotheringham Lakes) and Marmion Lake (Figure 5-30) suggests that densities are highest in the upper lakes earlier (May 20-22) than in Marmion Lake (May 29-June 2). This observation may be temperature related, in May near surface temperatures were approximately 2-4°C higher in the upper lakes (see Section 5.1.2).

Juvenile and Adult Fish

Beach Seines

The catch of fish in beach seines is listed in Appendix 10. The total beach seine catch was 31 131 fish representing 24 species. Blacknose shiner was the most frequently caught species contributing to 30% of the catch (Table 5-28). Yellow perch (28%) mimic shiner (21%) and white sucker were also relatively abundant. Young of the year walleye, northern pike, lake whitefish and cisco were included in the catch.

TABLE 5-27

LARVAL FISH CATCH ATIKOKAN 1981

Species	Location												
							Marmion Lake						
	Snow Lake	Icy Lake	Icy Outlet	Abie Lake	Abie Outlet	Fotheringham Lake	South	Central	North	North Outlet	Anderson Dam	Lower Seine	Total
Yellow Perch	25 (64.1)[1]	327 (91.3)	57 (58.2)	81 (61.8)	91 (40.3)	59 (63.9)	50 (72.5)	43 (29.1)	32 (88.9)	6 (40.0)	51 (83.6)	11 (55.0)	833 (64.5)
Iowa Darter	13 (33.3)	21 (5.9)	22 (22.4)	31 (23.7)	115 (50.9)	34 (36.6)	14 (20.3)	105 (70.9)	4 (11.1)	8 (53.3)	5 (8.2)	3 (15.0)	375 (29.0)
Cyprinidae (unident)		1 (0.3)	8 (8.2)	6 (4.6)	19 (8.4)		2 (2.9)			1 (6.7)		5 (25.0)	42 (3.3)
Pumpkinseed		7 (2.0)	10 (10.2)	11 (8.4)								1 (5.0)	29 (2.2)
White Sucker	1 (2.6)	1 (0.3)		1 (1.5)									8 (0.6)
Burbot											4 (6.6)		2 (0.2)
Walleye			1 (1.0)				1 (1.4)				1 (1.6)		1 (0.1)
Logperch		1 (0.3)											1 (0.1)
Lake Whitefish					1 (0.4)								1 (0.1)
Total	39	358	98	131	226	93	69	148	36	15	61	20	1292

[1] number and per cent

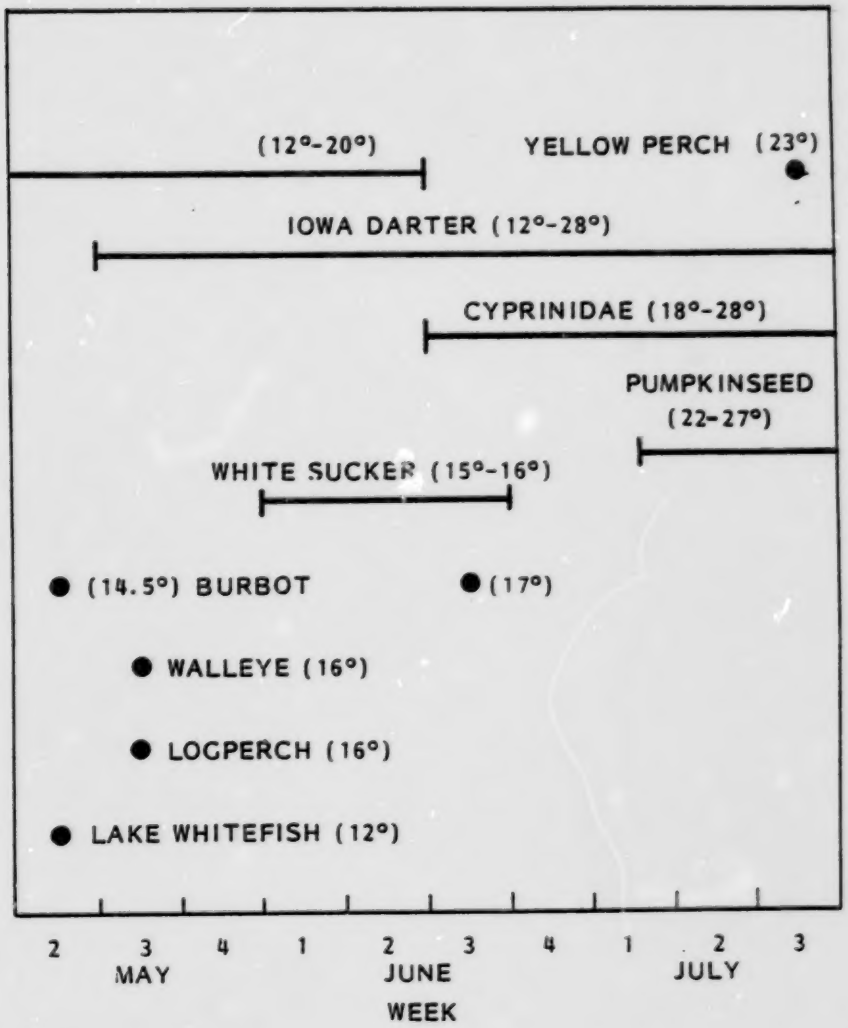


FIGURE 5-29

OCCURRENCE OF LARVAL FISH
RELATIVE TO DATE AND TEMPERATURE
ATIKOKEN 1981

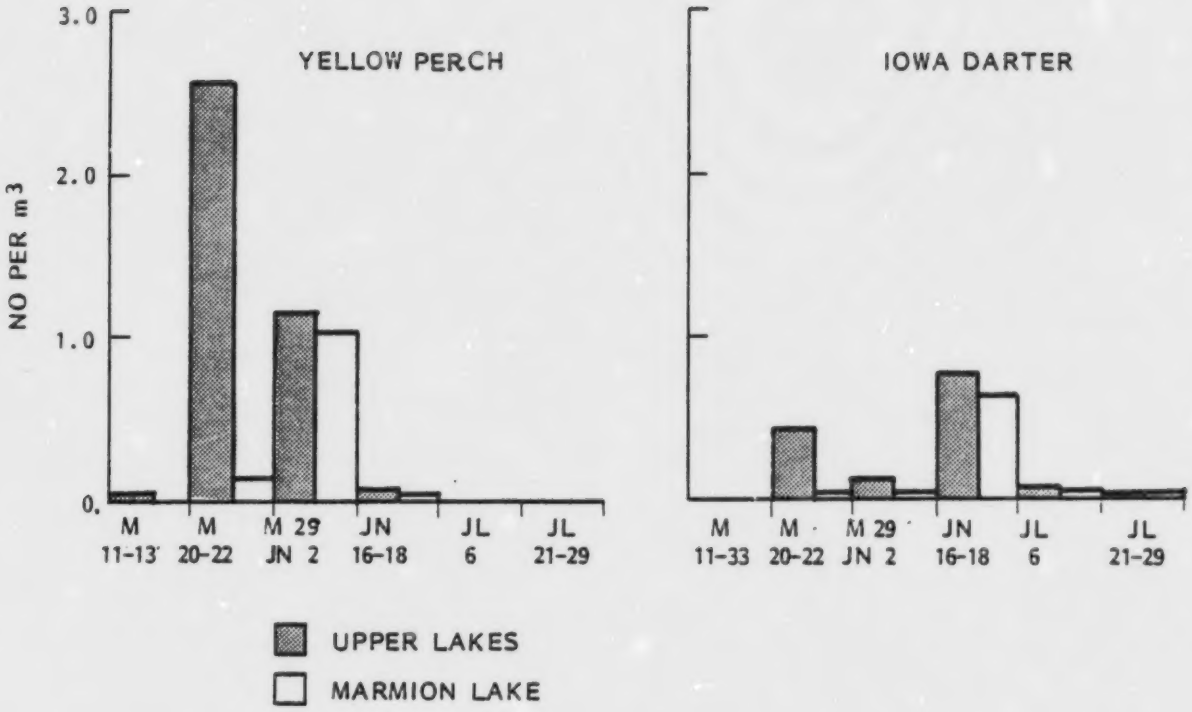


FIGURE 5-30

LARVAL FISH DENSITIES OF YELLOW PERCH AND IOWA DARTER IN THE UPPER LAKES AND MARMION LAKE - 1981

TABLE 5-28

PERCENT COMPOSITION OF BEACH SEINE CATCHES ATIKOKAN 1981

Species	Location											Total	
						Marmion Lake							
	Snow Lake	Icy Lake	Able Lake	Fotheringham Lake	Slush Lake	Lower Seine	South	Central	North	Anderson Dam	Moose Lake	n	%
Blacknose Shiner	41.3	45.8	43.5	31.7	62.2	24.1	2.5	21.5	0.5	12.3	9.7	9289	29.8
Yellow Perch	17.6	6.4	16.3	66.5	37.8	52.7	74.1	57.0	75.0	16.8	9.4	8685	27.9
Mimic Shiner	1.2	15.3	1.3			13.0	13.5	16.9	7.0	59.8	74.1	6499	20.9
White Sucker	1.9	29.2	0.1	0.2		0.4	0.6	0.5	3.0	2.8	1.1	3214	10.3
Golden Shiner	30.0		0.2			3.2	0.4	0.2	0.3		3.6	1110	3.6
Iowa Darter	4.7	0.2	18.5	1.4		1.1	0.4	0.7	0.4	0.3	2.1	650	2.1
Lake Chub		1.8	9.3				3.4		0.3			441	1.4
Logperch	0.1	0.1	1.4			0.3	2.0	1.4	4.6	5.6		400	1.3
Pumpkinseed	2.9	0.1	7.0			4.7		0.1	0.4			378	1.2
Spottail Shiner	0.1	0.9	1.7			0.1	1.6	*	0.4	1.5		256	0.8
Lake Whitefish	*					*	1.2	1.2				62	0.2
Burbot								0.4	3.3			37	0.1
Walleye		0.1							0.7	0.3		32	0.1
Northern Pike	*	*	0.5	0.1		*		*		*		19	0.1
Slimy Sculpin	0.2	*				0.1		*	0.3			14	*
Unident Cyprinidae						0.2	0.3	*				13	*
Fathead Minnow										0.3		11	*
Nine-Spine Stickleback						0.1	*		0.1	*		5	*
Bluntnose Minnow									0.1	0.1		5	*
Finescale Dace			0.1							*		3	*
Emerald Shiner			0.1				*					3	*
Trout-Perch										0.1		3	*
Redbelly Dace			0.1									1	*
Cisco									0.1			1	*
Total(n)	3,124	10,131	1,933	1,380	98	2831	2255	2830	789	4066	1694	31,131	
CUE	130	422	81	115	8	118	94	118	33	169	141	137	

* present <0.05% of the catch

The four most abundant species were collected from each sampling area with the exception of mimic shiner which was not collected from either Slush or Fotheringham Lakes and white sucker which was not collected from Slush Lake. Blacknose shiner was the most abundant species in the catch from Snow, Icy, Abie and Slush Lakes while yellow perch was the most abundant species caught in Fotheringham Lake, Lower Seine, Marmion South, Central and North. Mimic shiner was the most abundant species at Anderson Dam and Moose Lake.

One lake whitefish (young of the year) was beach seined in Snow Lake. As the presence of this species in Snow Lake was not confirmed by other sampling, the one specimen may have been in the net prior to sampling. Walleye young of the year were collected from Icy Lake, Marmion North and Anderson Dam; with the exception of Anderson Dam, each of those areas were close to spawning areas confirmed in 1981 (see Figure 5-31). The Anderson Dam location was relatively close to the spawning site at the outlet of North Twin Lake which was noted by Acres (1976). Northern pike were collected in beach seines from each of the upper lakes sampled before July and at Lower Seine, Marmion Central and Anderson Dam.

The catch per unit effort of all species, the most abundant and the important game species caught in beach seines are listed in Table 5-29. The catches of the abundant species varied greatly with date and with location (see Appendix 10). Blacknose shiner were more abundant in the upper lakes (CUE=73.7) than in Marmion Lake (15.4) while yellow perch and mimic shiner were more abundant in Marmion Lake (50.5 and 31.1) than in the upper lakes (25.7 and 16.8). These trends, however, were not consistent in all sampling periods.

Beach seine catches (all species) were generally highest from mid May through July while the seasonal distribution of the most abundant species were more variable. Young of the year lake whitefish were most abundant in May, walleye from mid June through July and northern pike from mid May through June.

Trap Nets

The fish catches in 1.2 and 1.8 m trap nets are recorded in Appendix 10 and summarized in Table 5-30. A total of 308 fish of six species were collected in the boxes of 1.2 m trap nets and 29 fish of five species were collected in the boxes of 1.8 m trap nets. Not included in these numbers are the fish gilled in the leads of trap nets (Table 5-31), these amounted to 197 fish of six species. Consequently, by the use of trap nets 534 fish representing eight species were caught as part of the pre-operational studies at Atikokan in 1981.

TABLE 5-29

CATCH PER UNIT EFFORT OF ABUNDANT AND SPORT FISHES IN BEACH SEINES - ATIKOKAN 1981

Species	Date								
	May 6-9	May 19-22	June 2-5	June 16-19	July 21-29	Aug 18-21	Sept 15-18	Sept 29 -Oct 2	All Dates
Upper Lakes									
Blacknose Shiner	22.7	209.6	161.7	79.7	65.5	35.9	14.3	0.1	73.7
Yellow Perch	7.7	24.4	2.2	77.5	61.8	22.0	6.9	3.3	25.7
Mimic Shiner	19.3	1.2	0.0	17.8	12.7	67.3	15.8	0.0	16.8
Lake Whitefish	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Walleye[1]	0.0	0.0	0.0	0.0	2.2	0.0	0.1	0.0	0.3
Northern Pike	0.0	0.2	0.3	7.6	0.1	0.0	0.1	0.1	1.1
All Species	64.1	268.5	206.1	397.3	173.6	163.6	45.4	4.1	165.3
Marmion Lake									
Blacknose Shiner	24.5	6.5	0.5	8.9	35.9	5.5	41.1	0.3	15.4
Yellow Perch	57.8	66.8	33.3	144.6	60.8	26.2	2.6	11.6	50.5
Mimic Shiner	0.6	7.6	18.0	4.0	135.9	54.5	25.3	3.1	31.1
Lake Whitefish	0.0	4.0	0.1	0.0	0.0	0.0	0.0	0.0	0.5
Walleye	0.0	0.0	0.0	0.9	0.3	0.0	0.0	0.0	0.2
Northern Pike	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
All Species	87.1	96.1	58.5	163.7	251.1	106.1	79.7	16.0	107.3

[1] Abie and Icy Lakes Only.

TABLE 5-30

SUMMARY OF CATCHES IN 1.2 m AND 1.8 m TRAP NETS, ATIKOKAN 1981

Species	Location											
						Marmion Lake						
	Snow Lake	Icy Lake	Able Lake	Fotheringham Lake	Slush Lake	South	Central	North	Lower Seine	Anderson Dam	Moose Lake	Totals
1.2 m Traps												
White Sucker	9(47.4)[1]	22(53.7)	19(28.8)	4(22.2)	5(62.5)	2(20.0)	4(16.0)	3(21.4)	4(21.1)	23(34.3)	8(38.1)	103(33.4)
Northern Pike	2(10.5)	14(84.1)	31(47.0)	12(66.7)	2(25.0)	2(20.0)	6(24.0)	3(21.4)	1(5.3)	24(35.8)	3(14.3)	100(32.5)
Walleye		4(9.8)	15(22.7)				8(32.0)	6(42.9)	10(52.6)	12(17.9)	1(4.8)	56(18.2)
Yellow Perch	3(15.8)	1(2.4)	1(1.5)			6(60.0)	6(24.0)	1(7.1)	4(21.1)	7(10.4)	9(42.9)	38(12.3)
Burbot	4(21.1)			2(11.1)	1(12.5)		1(4.0)	1(7.1)				9(2.9)
Pumpkinseed	1(5.3)									1(1.5)		2(0.6)
All Species	19	41	66	18	8	10	25	14	19	67	21	308
Number of sets	19	20	20	8	11	19	20	20	19	20	12	188
1.8 m Traps												
Northern Pike					1(50.0)	1(50.0)		1(100.0)	7(87.5)	3(50.0)		13(68.4)
White Sucker					1(50.0)					2(33.3)		3(15.8)
Lake Whitefish										1(16.7)		1(5.3)
Burbot									1(12.5)			1(5.3)
Cisco						1(50.0)				1(5.3)		
All Species					2	2		1	8	6		19
Number of Sets	2	2	2	0	2	4	3	3	5	4	2	29

[1] number and per cent composition

TABLE 5-31

NUMBERS OF FISH GILLED IN LEADS OF 1.2 AND 1.8 m TRAP NETS

ATIKOKAN 1981

Species	Location											
						Marmion Lake						
	Snow Lake	Icy Lake	Able Lake	Fotheringham Lake	Slush Lake	South	Central	North	Lower Seine	Anderson Dam	Moose Lake	Totals
Northern Pike	2	13	12	8	2	6	5	14	2	6	9	79 (40.1)
Walleye		8	5			14	9	3	15	3		57 (28.9)
Cisco		1	2			12	13	2	24			54 (27.4)
Lake Whitefish									1		2	3 (1.5)
White Sucker					1		1		1			3 (1.5)
Yellow Perch						1						1 (0.5)
All Species	2	22	19	8	3	33	28	19	43	9	11	197
Number of Sets	21	22	22	8	13	23	23	23	24	24	14	

As can be seen in Tables 5-30 and 5-31, the composition of fish caught in the boxes differed substantially from the composition of fish gilled in the leads. As the fish caught in the leads of trap nets are not conventionally included in catch statistics use of trap nets appears inadequate to sample the fish species in this lake system. In this case, the contribution of white sucker to fish caught in boxes of 1.2 m traps nets (33.4%) was substantially higher than its contribution to those fish caught in the leads (1.5%).

The numbers of fish caught in 1.2 m trap nets (Table 5-30) were largest at Anderson Dam (67 CUE=3.4) and in Abie Lake (66, CUE=3.3) while numbers were lowest at Marmion South (10, CUE=0.5), Marmion North (14, CUE=0.7) and in Slush Lake (8, CUE=0.7). Catches in the Upper Lakes (Moose Lake excluded) (CUE=1.9) on average were slightly higher than in Marmion Lake (Lower Seine included) (CUE=1.4).

Based on the trap net samples (including leads) northern pike and white suckers were present in each basin. Yellow perch were not collected from Fotheringham Lake, walleye were not collected from Snow, Fotheringham and Slush Lakes and cisco were not collected from Snow, Fotheringham and Slush Lakes and from Anderson Dam. Pumpkinseed and burbot were collected in small numbers from two and six locations respectively.

The composition and catch per net of the major species in 1.2 and 1.8 m trap nets (leads included) is in Table 5-32. Northern pike were relatively common at all locations as were walleye at the locations where they were caught. Most spatial variability was apparent in white sucker and cisco. In the case of white sucker highest composition values (>15%) and highest catch per net (>0.4) occurred in the upper basins Moose Lake and Anderson Dam. In a similar fashion cisco were either absent or a relatively minor component (<5%) of the catch in the upper lakes, Anderson Dam and Moose Lake, while at the Marmion Lake locations (excluding Anderson Dam) cisco comprised 6-34% of the catch.

The catch of the abundant species in 1.2 m trap nets varied among sampling dates (Table 5-33), however, there were no consistent trends.

As part of another study (Ontario Hydro Research Division Report in preparation) a comparison of catches in areas with and without trees could be made. In trap nets set along a slightly inclining shore without submerged trees near Anderson Dam in July, yellow perch was the most commonly caught species (37.1%, CUE=1.6, n=8 sets). Walleye, (17.1%, CUE=0.8) white sucker (20.0%, CUE=0.9) and northern pike (25.7%, CUE=1.1) were also

TABLE 5-32

COMPOSITION AND CATCH PER UNIT EFFORT OF THE MAJOR SPECIES CAUGHT IN 1.2 AND 1.8 m TRAP NETS (including leads)

Species	Location										
						Marmion Lake					Moose Lake
	Snow Lake	Icy Lake	Able Lake	Slush Lake	Fotheringham Lake	South	Central	North	Anderson Dam	Lower Seine	
Northern Pike	0.2 (19.0)	1.2 (42.9)	1.4 (50.6)	0.4 (38.5)	2.5 (76.9)	0.4 (20.0)	0.5 (20.8)	0.8 (52.9)	1.4 (40.2)	0.4 (14.3)	0.9 (37.5)
White Sucker	0.4 (42.9)	1.0 (34.9)	0.9 (22.4)	0.5 (53.8)	0.5 (15.4)	0.1 (4.4)	0.2 (9.4)	0.2 (8.8)	1.0 (30.5)	0.2 (7.1)	0.6 (25.0)
Walleye	0.0 (0.0)	0.5 (19.0)	1.6 (23.6)	0.0 (0.0)	0.0 (0.0)	0.6 (31.1)	0.7 (32.1)	0.4 (26.5)	0.6 (18.3)	1.0 (35.7)	0.1 (3.1)
Cisco	0.0 (0.0)	0.0 (1.6)	0.1 (2.4)	0.0 (0.0)	0.0 (0.0)	0.6 (28.9)	0.6 (24.5)	0.1 (5.9)	0.0 (0.0)	1.0 (34.3)	0.0 (0.0)

TABLE 5-33

CATCH PER UNIT EFFORT OF ABUNDANT SPECIES IN 1.20 m TRAP NETS - ATIKOKAN 1981

Species	Date										
	May 6-9	May 19-22	June 2-5	June 16-19	July 21-29	Aug 18-21	Sept 15-18	Sept 29 -Oct 2	Oct 13-16	Oct 27-30	All Dates
Upper Lakes											
Northern Pike	1.6	0.8	1.6	0.3	1.1	0.2	0.8	0.1	0.5	0.6	0.8
White Sucker	1.9	0.3	1.6	1.1	0.1	0.1	0.9	1.1	0.1	0.1	0.7
Walleye[1]	1.3	0.0	0.5	1.5	0.8	0.8	0.0	0.0	0.0	0.0	0.5
Yellow Perch	0.1	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1
All Species	4.5	1.0	3.8	2.3	1.7	1.0	1.9	1.6	0.6	0.7	1.9
Marmion Lake											
Northern Pike	0.8	0.4	0.3	0.1	0.5	0.2	0.4	0.3	0.3	0.3	0.4
White Sucker	0.7	1.8	0.0	0.5	0.1	0.3	0.2	0.0	0.1	0.0	0.4
Walleye	0.0	0.6	0.3	1.0	1.4	0.2	0.3	0.7	0.0	0.0	0.5
Yellow Perch	0.0	0.1	0.3	0.4	1.3	0.2	0.2	0.2	0.0	0.0	0.3
All Species	1.8	2.9	0.9	0.8	3.3	0.8	1.2	1.2	0.5	0.3	1.4

[1] Icy and Abie Lakes Only.

present. In an adjacent area with a similar incline, but with submerged trees present, smaller catches (n=8 sets) of similar composition were recorded (yellow perch, 50.0% CUE=1.0; walleye 12.5% CUE=0.3; white sucker 12.5%, CUE=0.3; northern pike 25.0% CUE=0.5). In contrast in an area of a sharp incline with no trees, no yellow perch were caught and walleye was the most common species (50.0%, CUE=1.6). White sucker (30.8%, CUE=1.0) and northern pike (19.2%, CUE=0.6) were also present.

Based on catches from all gear types and incidental catches and observations, Table 5-34 which indicates the distribution (presence) of the observed species in the study area was prepared. A total of 23 fish species were collected in the study area. Twenty-two of these species (redbelly dace excluded) were observed in locations of Marmion Lake. Of the remaining lakes Slush and Fotheringham Lakes had the fewest species (5 and 6) while Abie Lake had the most.

Ministry of Natural Resources (MNR) surveys of Marmion Lake (OMNR Bathymetric Map Series 1972) identified three additional species which were not included in our records, longnose dace, blacknose dace and redbelly dace. Ten species that were observed in 1981 were not included in the MNR listing. Similarly, with the exception of lake whitefish in Icy Lake, netting in 1981 confirmed the presence of species identified in 1975 (Acres 1976).

Fewest species were identified in the upper lakes in the cooling circuit. However, with dredging of the outlets of Icy and Abie Lakes, fish absent from Icy Lake may colonize from the downstream basins.

Mark-Recapture Results

During 1981, 186 northern pike and 70 walleye were marked with Floy tags. As of June 7, 1982, 10 tags or about 4% have been returned (Table 5-35). Of the ten returns, four were returned by anglers.

Based on the small number of returns, population estimates cannot be made (see Ricker 1975 for discussion). However, one important fact did arise from the mark recapture results. Two walleye which were marked over spawning grounds at the outflow of Icy Lake into Abie Lake were angled in Marmion Lake. This would indicate that walleye from Marmion Lake move into the weir at the exit of Icy Lake to spawn. With the removal of the weir in 1982, walleye may move up into Icy Lake to spawn where water temperatures and currents will be more influenced by station operation.

TABLE 5-34

FISH SPECIES LISTS - ATIKOKAN 1981

	Moose Lake	Snow Lake	Icy Lake	Slush Lake	Fotheringham Lake	Abie Lake	Marmion Lake					Total
							Lower Seine	South	Central	North	Anderson Dam	
Cisco			X			X	X	X	X	X	X	X
Lake Whitefish	X	X				X	X	X	X		X	X
Northern Pike	X	X	X	X	X	X	X	X	X	X	X	X
Redbelly Dace						X						
Finescale Dace						X					X	X
Lake Chub			X			X		X		X		X
Golden Shiner	X	X				X	X	X	X	X		X
Emerald Shiner						X		X				X
Blacknose Shiner	X	X	X	X	X	X	X	X	X	X	X	X
Spottail Shiner		X	X			X	X	X	X	X	X	X
Mimic Shiner	X	X	X			X	X	X	X	X	X	X
Bluntnose Minnow										X	X	X
Fathead Minnow											X	X
White Sucker	X	X	X	X	X	X	X	X	X	X	X	X
Burbot		X		X	X		X	X	X	X		X
Nine-spine Stickleback							X	X		X	X	X
Trout-Perch											X	X
Pumpkinseed		X	X			X	X		X	X	X	X
Yellow Perch	X	X	X	X	X	X	X	X	X	X	X	X
Walleye	X		X			X	X	X	X	X	X	X
Iowa Darter	X	X	X		X	X	X	X	X	X	X	X
Logperch		X	X			X	X	X	X	X	X	X
Slimy Sculpin		X	X				X		X	X		X
Total Species	9	13	13	5	6	17	16	16	15	17	17	22

TABLE 5-35

RECAPTURES OF MARKED NORTHERN PIKE AND WALLEYE, ATIKOKAN 1981

Basin	Number Tagged		Number Recaptured		Per Cent Recaptured		Site of Recapture	
	Pike	Walleye	Pike	Walleye	Pike	Walleye	Pike	Walleye
Snow Lake	2	-	0	-	0.0	-		
Icy Lake	17	5	0	0	0.0	0.0		
Abie Lake	26	22	2	3	7.7	13.6	Abie Lake	Abie Lake (1) Marmion Lake (2)
Slush Lake	5	-	0	-	0.0	-		
Fotheringham Lake	12	-	0	-	0.0	-		
Marmion Lake								
South	3	2	0	0	0.0	0.0		
Central	6	7	0	0	0.0	0.0		
North	16	5	0	0	0.0	0.0		
Anderson Dam	42	25	3	0	7.1	0.0	Anderson Dam	
Lower Seine	10	3	0	0	0.0	0.0		
Moose Lake	47	1	2	0	9.3	0.0	Moose Lake	
Totals	186	70	7	3	3.8	4.3		

All other recaptures of walleye and all of northern pike were recaptured in the area of their release.

Spawning

During the period April 29 through May 15 a number of sites were checked 1 to 5 times for the presence of spawning walleye. The spawning locations as well as other locations that were checked are in Figure 5-31. Temperatures at which ripe walleye were observed ranged from 6°C at the west dam to 12°C at the outflow of Ski Lake into Icy Lake. All areas at which walleye spawning was observed had some flow. Despite the presence of suitable substrate (gravel-cobble) no walleye were observed in still water on shoals in Marmion Lake.

The spawning areas observed were similar to those identified by MNR and reported by Acres (1976) with the exception of the outflow of the North Twin Lake where no walleye were observed and South Twin Lake which was not checked in 1981.

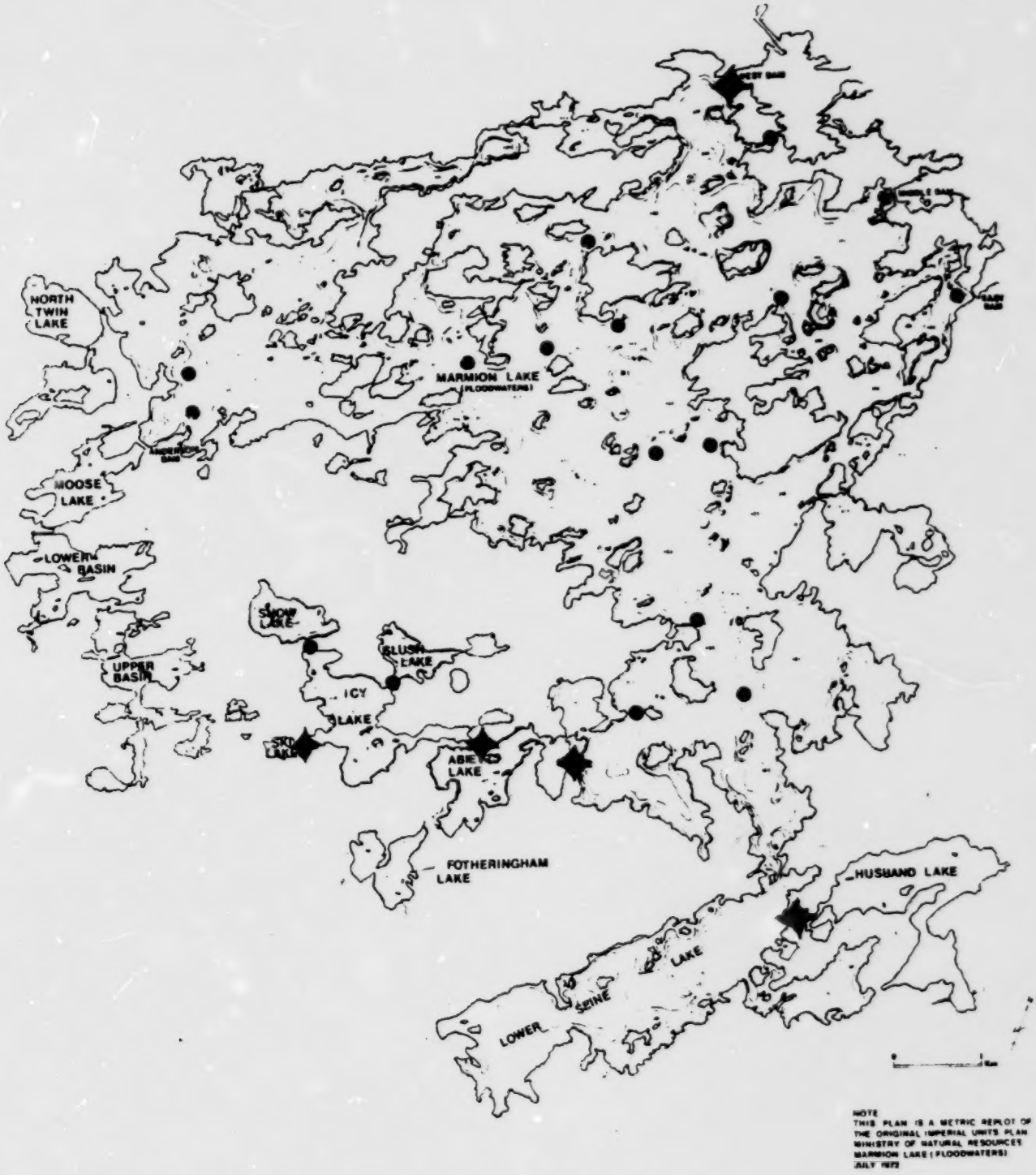
Observations of other species in spawning condition are listed in Table 5-36. The dates and temperatures at which ripe individuals were observed fall within those reported by Scott and Crossman (1973). Although many prespawn coregonids (cisco and lake whitefish) were observed in October and November (last date November 4), no spawning individuals were collected.

TABLE 5-36

CHRONOLOGY OF SPAWNING,* ATIKOKAN 1981

Species	Dates**	Water Temperatures (°C)
Walleye	Apr 30 - May 19	6 - 14
Northern Pike	May 08 - May 19	10 - 14
Yellow Perch	May 01 - May 19	7 - 8
White Sucker	May 08 - May 19	10 - 14.5
Blacknose Shiner	Jun 02***	15
Logperch	May 21 - Jun 02	14.5 - 15.5
Spottail Shiner	May 21***	14.5
Iowa Darter	May 21***	16
Finescale Dace	May 21***	16

* Flowing sexual products.
** Dates on which first individual with flowing sexual products was observed and date before which spawning was completed.
*** Only date on which fish in spawning condition were caught.



◆ Verified spawning area

● Other locations checked

FIGURE 5-31

WALLEYE SPAWNING AREAS
ATIKOKAN 1981

158672-RD
83-338

ACOUSTIC FISH CENSUS

General Features of Fish Distribution

The mid-summer acoustic survey revealed the presence of substantial pelagic fish communities in several basins. Pelagic fish made up the bulk of acoustic targets, while lesser numbers of fish were observed to be closely associated with rocky shorelines and shoals.

The distribution of fish within the five basins sampled acoustically is summarized in Table 5-37. The greatest numbers of fish were observed in midwater in the two deep basins, Marmion Lake and Lower Seine Lake.

Most fish in these basins were relatively large (strong acoustic reflectors) and scattered in a diffuse band in midwater. Examples of this pattern of distribution are seen in analog echograms from Marmion Lake (Figure 5-32) and Lower Seine Lake (Figure 5-33). In some areas clusters or dense schools of smaller fish were found within the bands of larger fish. Such schools were most frequently encountered in Lower Seine Lake, where a series of four schools was observed within 150 m on the middle transect. In the three shallow basins sampled, pelagic fish were either more restricted in distribution (Abie Lake) or rare (Marmion Lake and Icy Lake).

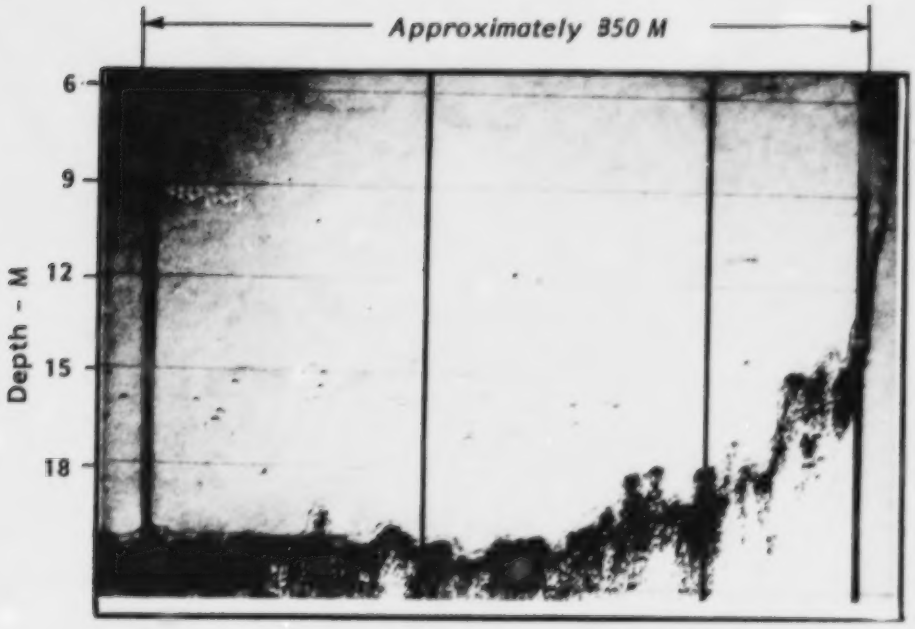
Fish were most often found near the substrate where the midwater layers met the rising lake bottom. In addition, small-to-moderate numbers of fish were found at shallower depths along the slopes and on shoals. Such fish were most often observed in the deep basin of Marmion Lake and in Lower Seine Lake. Below the bands of midwater concentration in the deepest portion of the basins, fish were either rare or appeared to be absent. In both Marmion Lake basins extensive areas of submerged trees were observed to considerable depth (eg, Figure 5-32). Fish did not appear to aggregate around trees, although those very close to the trees would not have been resolved acoustically.

Spatial differences in fish abundance which were not obviously associated with depth or topography were found in two basins: Lower Seine Lake and Abie Lake (Table 5-37). The greatest differences were observed in Abie Lake, where almost all fish were localized in the west-central portion of the sampling grid.

TABLE 5-37

SUMMARY OF ACOUSTIC OBSERVATIONS OF FISH DISTRIBUTION, AUGUST, 1981

	Fish Associated With Bottom			Fish in Midwater	Other Spatial Trends Within Basins
	Slopes	Shoals	Soft Bottom		
Harmion Lake: Shallow Basin	Small Numbers of Individuals, Occasional Clusters	-	Occasional Individuals	Occasional Individuals	None
Harmion Lake: Deep Basin	Small to Moderate Number of Individuals, and Clusters	-	Occasional Individuals and Clusters	Diffuse Layer of Many Individuals; Occasional Schools of Smaller Fish	None
Lower Seine Lake	Very Few, Except in Deeper Portions	Clusters on Both Deep & Shallow Shoals	Very Few Individuals	Diffuse Layer of Many Individuals; Moderate Schools	Greater Midwater Concentration in Mid-To-West Portion of the Grid
Able Lake	None	-	None	Moderate Numbers of Individuals & Occasional Schools Concentrated in a Thin Layer	Most Fish in West-Central Portion of Grid
Icy Lake	Occasional Individuals	Small Aggregation on One Shoal	None	Occasional Individuals and One School .	None

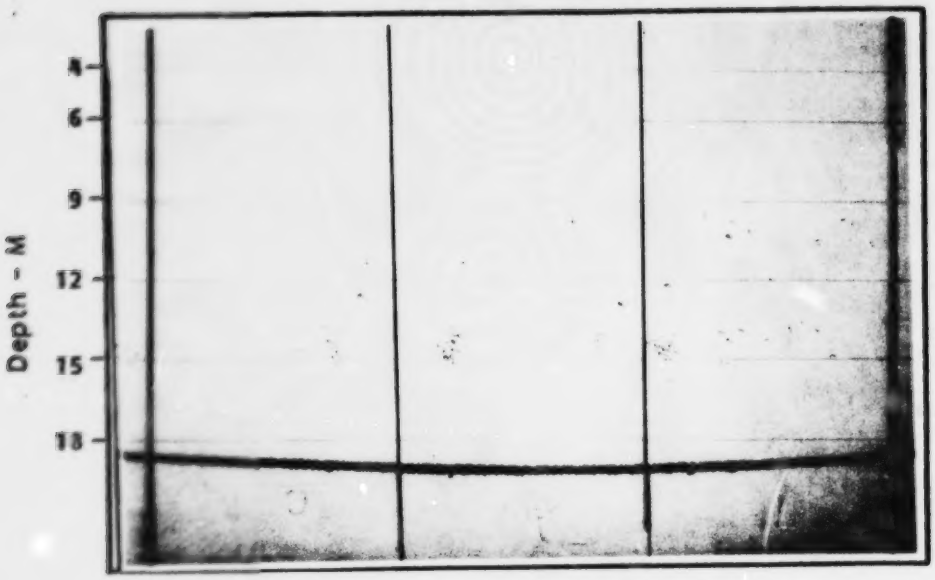


Location: Marmion Lake, Deep (Eastern) Basin, Transect 3, East End.

Features: Layer of Large Individual Fish Concentrated at 15 - 17 M Depth. Irregular Lower Slope, With Many Submerged Trees.

FIGURE 5-32

PORTION OF ECHOGRAM OBTAINED IN MARMION LAKE (DEEP BASIN) ACOUSTIC FISH CENSUS ON AUGUST 12, 1981



Location: Lower Seine Lake, Middle of Transect 4.

Note: Several Dense Schools of Small Fish at 14 - 15 M Depth.

Approximately 440 M

Location: Lower Seine Lake, Towards East End of Transect 3.

Note: Layer of Large Individual Fish at 11 - 15 M Depth. Bedrock Visible 3 M Below the Sediment Surface.

FIGURE 5-33

PORTIONS OF ECHOGRAM OBTAINED IN LOWER SEINE LAKE ACOUSTIC FISH CENSUS, AUGUST 13, 1981

Vertical Distribution of Fish in Relation to Temperature and Oxygen

The vertical extent of fish observed acoustically in midwater is shown in Figure 5-34.

The breadth and position in the water column of the layer-like aggregations varied considerably from basin to basin. In the deep basins of Marmion Lake and Lower Seine Lake the midwater aggregations extended approximately 5 m through the water column. Although the upper margin was 2 m lower in Marmion Lake (12 m) than in Lower Seine Lake (10 m), it corresponded to a temperature of 10°C (mid-basin temperature profiles, (Appendix 11) in both cases. In these basins the midwater layers of fish were found 4 to 5 m below the thermocline, (zone of sharp thermal gradient). By contrast, in the shallower basins of Icy Lake and Abie Lake the midwater echoes occupied a narrow band (1.5 m) within the thermocline. The upper margins of the bands were at 16 to 18°C.

To allow association of vertical fish distribution with oxygen levels, oxygen and temperature profiles taken two weeks previously in normal monthly sampling were included in Figure 5-34. In three of the basins, Lower Seine Lake, Abie Lake and Icy Lake, the monthly profiles and acoustic survey profiles were taken in approximately the same location. In these basins, the July 30 oxygen profiles are representative of conditions in August, based on the close similarity of temperature profiles in the two months, and the lack of significant change in oxygen profiles from July 30 to September 8 (Appendix 11). It is apparent that the lower limit of fish distribution (except for rare individuals in Lower Seine Lake) coincided with approximately 2 ppm oxygen in all three basins. In Marmion Lake the only deep (18 m+) monthly temperature and oxygen profiles were available from the south basin location, 4 km from the deep basin surveyed acoustically to the east. Somewhat lower temperatures below 10 m suggest that the south basin may be less subject to mixing and consequently more prone to hypolimnetic oxygen depletion than the eastern basin. In any case, midwater fish concentrations in the eastern basins are not likely to have extended into anoxic waters.

Species Composition and Ecology

As part of the acoustic survey a total of 118 fish of six species were taken in gill nets set in midwater in areas of pelagic fish concentration (Table 5-38, Appendix 12). Two coregonids, cisco *(Coregonus artedii)* and lake whitefish *(Coregonus clupeaformis)* were the dominant species. They were the only

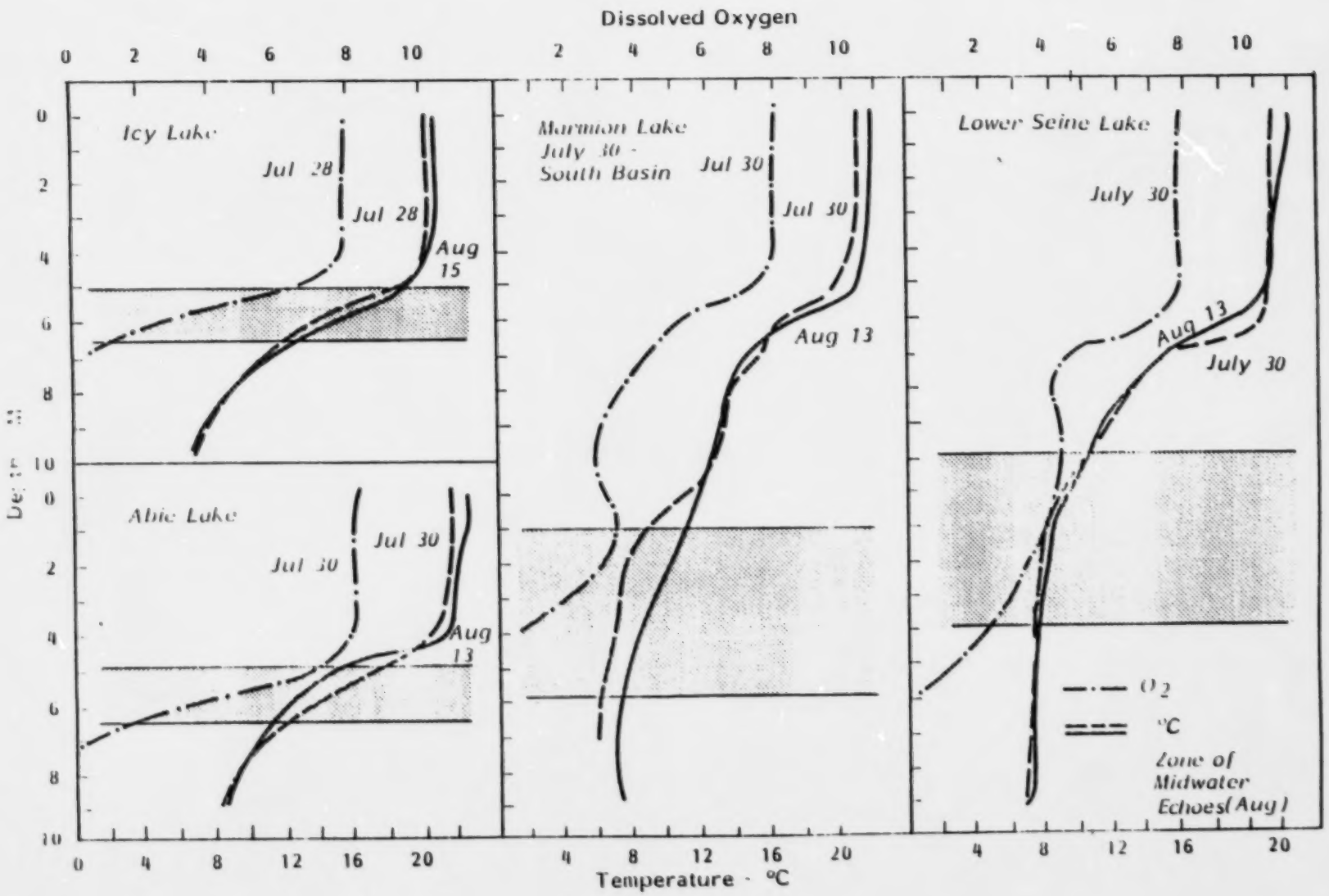


FIGURE 5-34

VERTICAL EXTENT OF MIDWATER FISH ECHOES IN RELATION TO TEMPERATURE AND DISSOLVED OXYGEN

species taken in four basins, and together contributed 84% of the total catch. White sucker and walleye were next in total numbers caught.

The proportion of the two coregonid species varied from basin to basin (Figure 5-35). Lake whitefish equalled cisco in the catch in Lower Seine Lake, while ciscos predominated Abie Lake and, to a lesser extent, in Marmion Lake (deep basin).

In stratified lakes, the portion of the water column habitable by cold water species such as cisco, whitefish and lake trout is limited at the upper margin by high temperature and may be limited at the lower margin by low oxygen concentration (eg, Colby and Brooke 1969; Evans 1978). In this context the temperature and oxygen requirements of cisco and whitefish can largely explain both their relative importance in the different basins and the vertical distribution of pelagic fish observed acoustically.

The upper margins of pelagic fish concentrations in the deep basins of Marmion Lake and Lower Seine Lake were located at 10°C. A similar distribution (10°C or lower) was reported by Kennedy (1943) for lake whitefish in Lake Opeongo, Ontario in September, while Engel and Magnuson (1976) found cisco concentrated in waters of approximately 10°C in Pallette Lake, Wisconsin, in summer. Coutant (1975) cited preferred temperatures of 7 to 10°C for cisco and 11 to 12°C for lake whitefish.

TABLE 5-38

FISH SPECIES COMPOSITION IN MID-WATER GILL NETS
AUGUST, 1981

Species	No	%
Cisco	64	53
Lake whitefish	38	32
White sucker	8	6
Walleye	5	4
Burbot	3	3
Northern pike	2	1
	120	

The lower margin of fish concentrations in Lower Seine Lake was at approximately 2 ppm oxygen. Evans (1978) suggested a slightly higher level of 3 ppm at the lower lethal concentration for lake whitefish, although he gave no data for lake whitefish

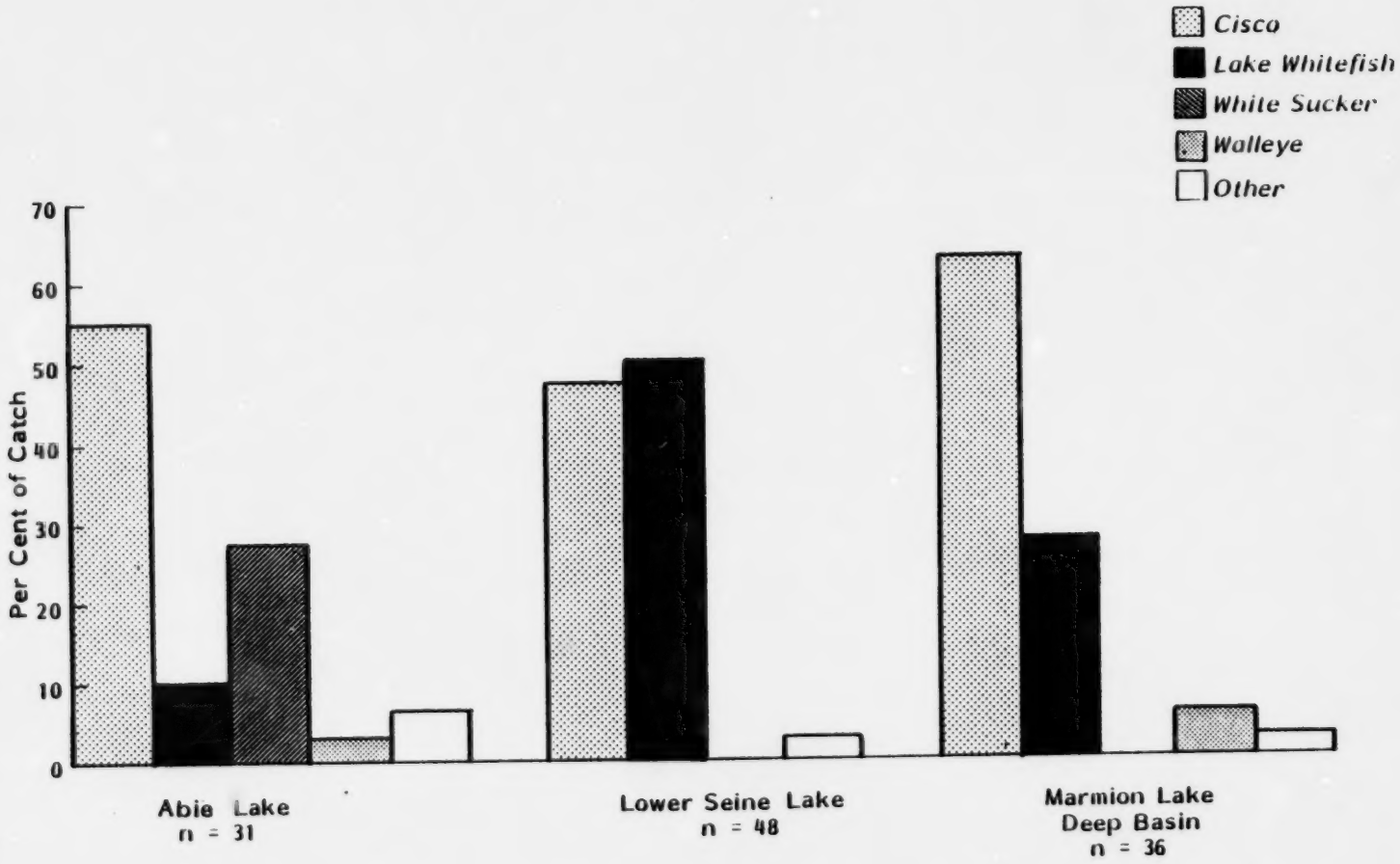


FIGURE 5-35

COMPOSITION OF MIDWATER GILL NET CATCH IN 3 BASINS
ACOUSTIC FISH CENSUS, SUMMER, 1981

and cited lethal levels ranging from 1 to 3.8 ppm for the young of several species of *Coregonus*. The data of Engel and Magnuson (1976) suggested that cisco avoided oxygen concentrations below 2 to 3 ppm, while Colby and Brooke (1969) indicated that cisco kills occurred when the 20°C isotherm and 3 ppm oxygen concentrations overlapped. It appears that in the deep basins at Atikokan, coregonids occupy the portion of the water column which is at their preferred temperature to a depth at which oxygen is just above lethal levels. In late summer this gives them a vertical range of only 4 to 5 m and it is questionable whether moderate levels of activity would be sustained in the lower portion of that range, due to the low oxygen concentration (Beamish, 1964).

Abie Lake was a comparatively shallow basin with a sharp thermal gradient. Waters at the temperatures associated with pelagic fish concentrations in the two deep basins (8 to 10°C) were completely anoxic in Abie Lake. Instead, these fish were found at 11 to 16°C. Again, the lower margin of their distribution was at approximately 2 ppm oxygen. In Abie Lake fish occupied a vertical range of only 2 m, all above the area of preferred temperature for coregonids, though apparently well within the zone of temperature tolerance. The strong predominance of cisco may be related to their tendency to enter warmer waters more readily than lake whitefish (Evans 1978).

The availability of areas of bottom which can be exploited by coldwater species for benthic feeding may be a factor limiting the distribution of lake whitefish. Cisco are pelagic, largely planktivorous feeders; the whitefish diet usually consists of benthic insects (Evans, 1978). Areas of bottom which have both cold water temperatures and sufficient oxygen are rather limited in Lower Seine and Marmion Lakes, but are vertically nonexistent in Abie Lake. On the other hand, acoustic recorders did not indicate concentrations of fish near bottom in those areas, suggesting that the whitefish may be pelagic as well as benthic feeders. Support for this hypothesis is provided by a comparative study of lake whitefish in northern Manitoba lakes (Kliewer 1970). In four lakes with a moderately abundant benthic fauna and well-oxygenated hypolimnion, 74 to 93% of the diet was composed of benthic organisms. In three lakes with a poor benthic fauna but abundant plankton the proportion of benthic food declined to 42 to 59%. The lowest proportion of benthic food consumed (42%) was found in the only lake with a poorly oxygenated hypolimnion. In Abie Lake the low abundance of lake whitefish could be due in part to competition with other users for a limited pelagic food resource.

White sucker occurred in the pelagic zone of Abie Lake at temperatures 4 to 6°C below reported preferred temperatures

(Coutant 1975; Reutter and Herdendorf 1974). This is difficult to explain, unless their summer preferred temperatures are lower than those reported previously. Since only a limited area of bottom in shallower water was not anoxic, the suckers may also have moved offshore by day to avoid predation by northern pike.

Walleye catches were sporadic and spanned a large range of depth and temperature. It is interesting to note that two large walleye, 53 and 62 cm fork length, were taken in Marmion Lake in midwater at 15 m depth and 8°C water temperature. It is possible that in summer large walleye prey on cisco in the deep pelagic environment.

Creel Census

Twenty-six replies to our questionnaire appeared to have usable information. This information is summarized in Table 5-39. Most replies (12) were from parties who did not specify the area in Marmion Lake that was fished. The other replies were from fishermen who utilized areas near Marmion North (6), Anderson dam (4), Lower Seine (3) and the Seine River (1). On average each party consisted of about four people and their stay was about two days.

Walleye was the most frequently reported species and was the most sought after as only about 10% of the 616 reported were returned to the water. Northern pike catches were underestimated as several replies only listed them as being caught, but not enumerated. The fact that approximately 40% of the northern pike caught were returned suggests that this species was less desirable among anglers. Only one lake whitefish was listed in the replies.

If a six-hour fishing day per person is assumed, the catch per man-hour of walleye would be approximately 0.4. This compares reasonably well with an average catch per man-hour of 0.67 (range 0.4 to 1.6) in Lac des Milles Lac, northwest of Thunder Bay, from 1958 to 1975 (Elsey and Thomson, 1977).

Among the other basins, anglers were observed in Abie, Snow and Moose Lakes. The latter was frequented by individuals employed on the construction site.

Species Accounts

Walleye

Walleye are present in Marmion Lake, Lower Seine Lake, Abie Lake and Icy Lake. In the study area walleye has the highest recreational value.

TABLE 5-39

ATIKOKAN CREEL CENSUS RESULTS
JULY 9 TO SEPTEMBER 15, 1981

Location	Average No in Party	Average No of Man-Days Per Party	Fish Caught	Catch Per Man-Day	Origin of Fishermen
Marmion General n=12	3.4	7.4	Northern Pike= 85 Walleye=301 Lake Whitefish= 1	1.0 3.4 0.0	Non-Residents= 1 Unknown=11
Marmion North n= 6	5.7	20.7	Northern Pike= 81 Walleye=292	0.7 2.4	Local= 2 Non-Residents= 2 Unknown= 3
Anderson Dam n= 4	3.5	3.5	Northern Pike= 24 Walleye= 6	1.7 0.4	Non-Residents= 3 Unknown= 1
Lower Seine n= 3	3.0	3.0	Northern Pike= 5 Walleye= 8 Yellow Perch= 1	0.6 0.9 0.1	Unknown
Upper Seine n= 1	6.0	6.0	Northern Pike= 1 Walleye= 9	0.2 1.3	Unknown
All Locations n=26	4.0	9.3	Northern Pike=196 Walleye=616 Lake Whitefish= 1 Yellow Perch= 1	0.8 2.5 0.0 0.0	Local= 2 Groups Non-Residents= 5 Groups Unknown=19 Groups

Spawning occurred within a few weeks following ice breakup (mid-April to mid-May) when water temperatures were 6 to 14°C. Spawning was observed in the same areas as reported by Acres (1976) with the exception of the outflow from North Twin Lake. Fish which would have normally spawned at that location may have moved into North Twin Lake to spawn. Despite several dives on shoals in Marmion Lake no spawning was observed in areas other than those with some water flow. Mark recapture information indicated that walleye would move from Marmion Lake into the outflow of Icy Lake to spawn. This would imply that dredging of the channel between Icy and Abie Lakes and equilization of water levels may result in walleye moving further up into Icy Lake to spawn.

After spawning, walleye move back into the lakes and their distribution with depth is dependent upon light intensity (see Scott and Crossman 1973). When turbidity is low and light penetration is high, walleye will most likely be found during the day in relatively deep water or in shallow water in association with cover (macrophytes, submerged logs, etc). The latter distributions are associated with temperature preference of the species (13 to 18°C in Lac la Rouge, Saskatchewan, Rawson 1957). Distribution at night is generally more widespread with increased movement throughout the water column, associated with feeding (Scott and Crossman 1973). Placement of nets amongst the standing trees in Marmion Lake during July when surface temperatures were in excess of 20°C did not result in large catches of walleye, suggesting that during the summer the flooded areas are not used extensively for cover by walleye. Acoustic grids and associated gill net sets run during the summer, suggest that during the diurnal period at least some walleye were found in mid-water at depths of up to 15 m.

Walleye in a reservoir of the upper Mississippi showed an affinity for backwater areas with a slight flow (0.1 to 0.2 m/s) (McConville and Fossum 1981), suggesting that currents generated by station operation may potentially affect the distribution of walleye in the cooling water circuit.

The age distribution of walleye collected in 1981 is in Figure 5-36. The walleye captured during 1981 ranged in age from 1+ to 14+. The most common age group was 3+. Within the range of ages collected, only the 1971 year class was not represented. In Lac des Milles Lacs, Elsey and Thomson (1977) found that experimental trap nets were not effective in catching fish in excess of eight years of age. Consequently older fish may be under-represented in our sample.

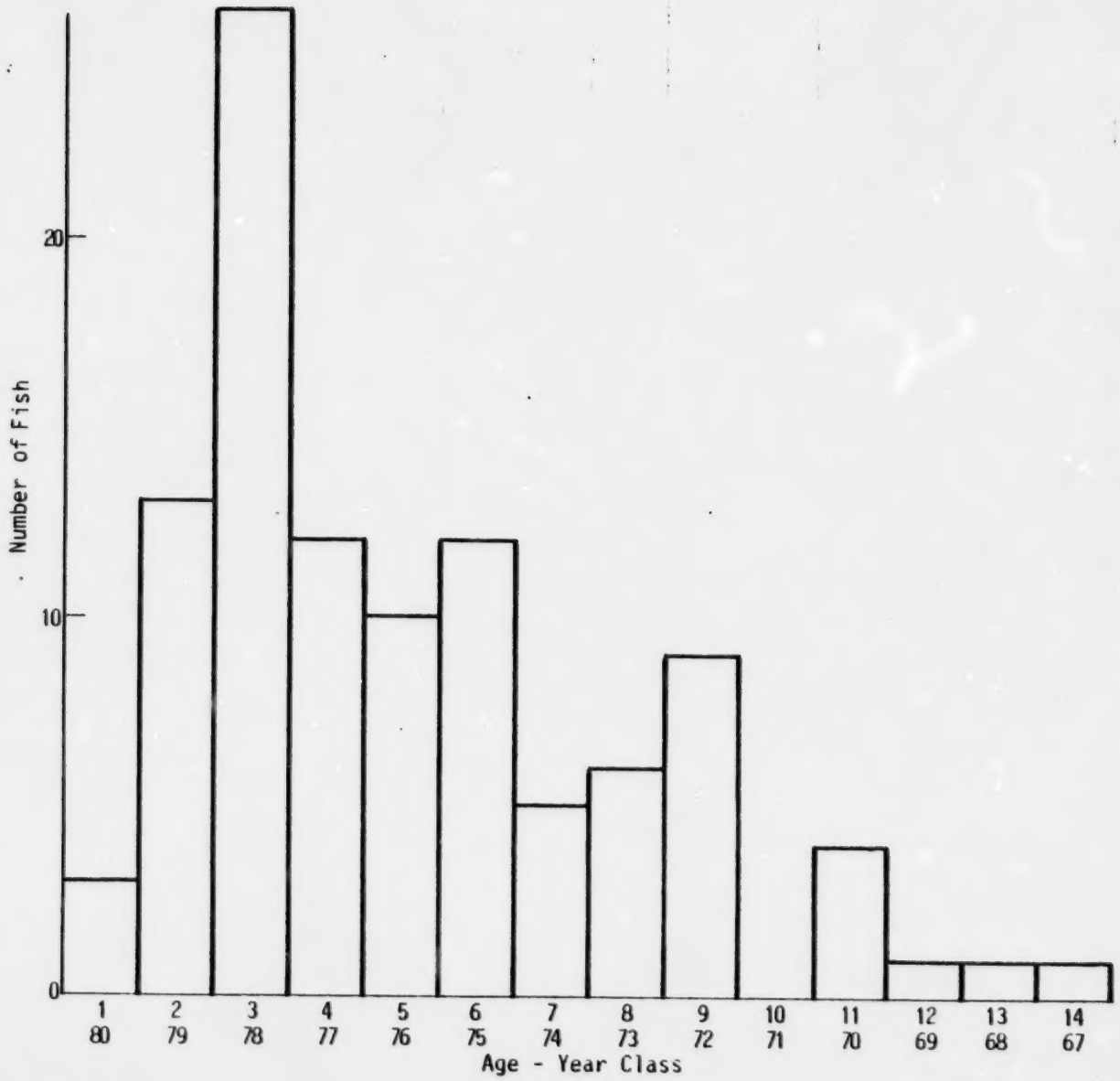


FIGURE 5-36

AGE DISTRIBUTION OF WALLEYE - ATIKOKAN 1981

158658 RD

An age-fork length histogram is illustrated in Figure 5-37. Mean fork-lengths at age were similar to those of walleye from Lac des Milles Lacs (Elsey and Thomson 1977) and below those of walleye from Lake Erie (Wolfert 1977).

The length-weight relationship for walleye is illustrated in Figure 5-38. For comparative purposes a similar curve for female walleye from Lake Erie is presented. Although several studies have demonstrated growth differences between male and female walleye (example Wolfert 1977) the length-weight regression of both male and female walleye combined had a relatively high correlation coefficient (r=0.940).

Northern Pike

Northern pike are present throughout the study area and consequently are a major component of the recreational catch, although less prized than the walleye.

Northern pike in spawning condition were collected through the second and third week in May when temperatures were 10 to 14°C and were collected at almost all locations. Pike generally spawn in heavily vegetated bays or adjacent marshes and creeks (Scott and and Crossman 1973) and thus would be expected to spawn over weed beds through most of the study area. The young of the year pike remain in the weed beds and are consequently not easily collected by conventional sampling gear.

Recaptures of adult northern pike were always from the same areas in which they were released. This is consistent with other studies which suggest that northern pike, although relatively active during spawning, are relatively sedentary through the rest of the year (Scott and Crossman 1973, Diana et al 1977). In Lac Ste Anne, Alberta, northern pike were generally found in water less than 4 m deep in association with macrophytes and relatively close to shore (<300 m), while in winter they were more often found in deeper water in areas of no vegetation and further from shore (Diana et al 1977). The association of pike with macrophytes is so strong that Grimm (1980) suggested that the standing stock of pike <54 cm in length was determined by the amount of aquatic vegetation. At Atikokan, there was no apparent preference by pike for areas of submerged trees compared to a similar area without trees. Areas of macrophytes were not extensively sampled in 1981.

The age distribution of northern pike collected in 1981 is given in Figure 5-39. The most commonly occurring age groups were four and five years in both the upper lakes and Marmion Lake. Fish in excess of nine years were caught only in the upper lakes.

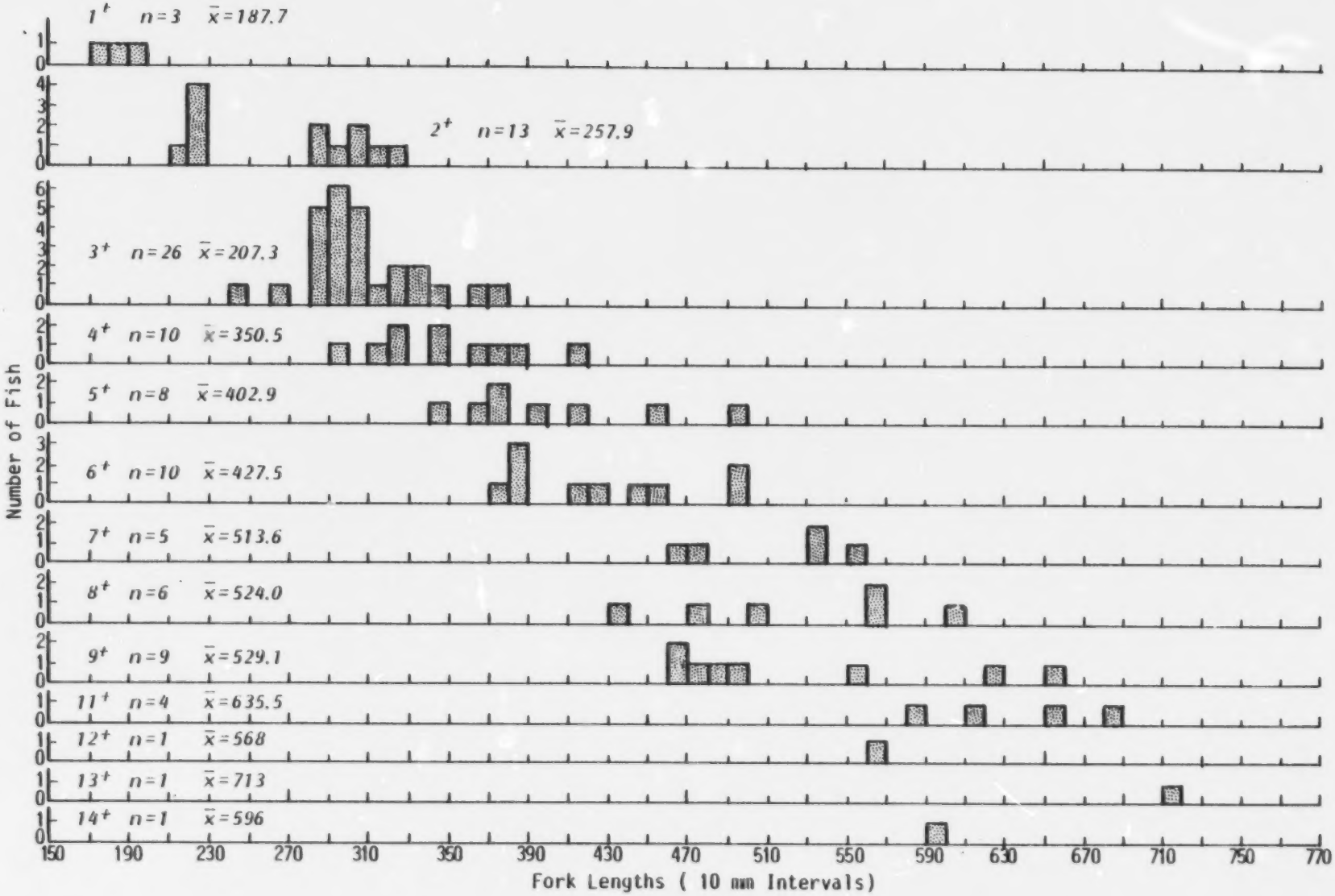


FIGURE 5 - 37

AGE-LENGTH HISTOGRAM FOR WALLEYE
ATIKOKAN 1981

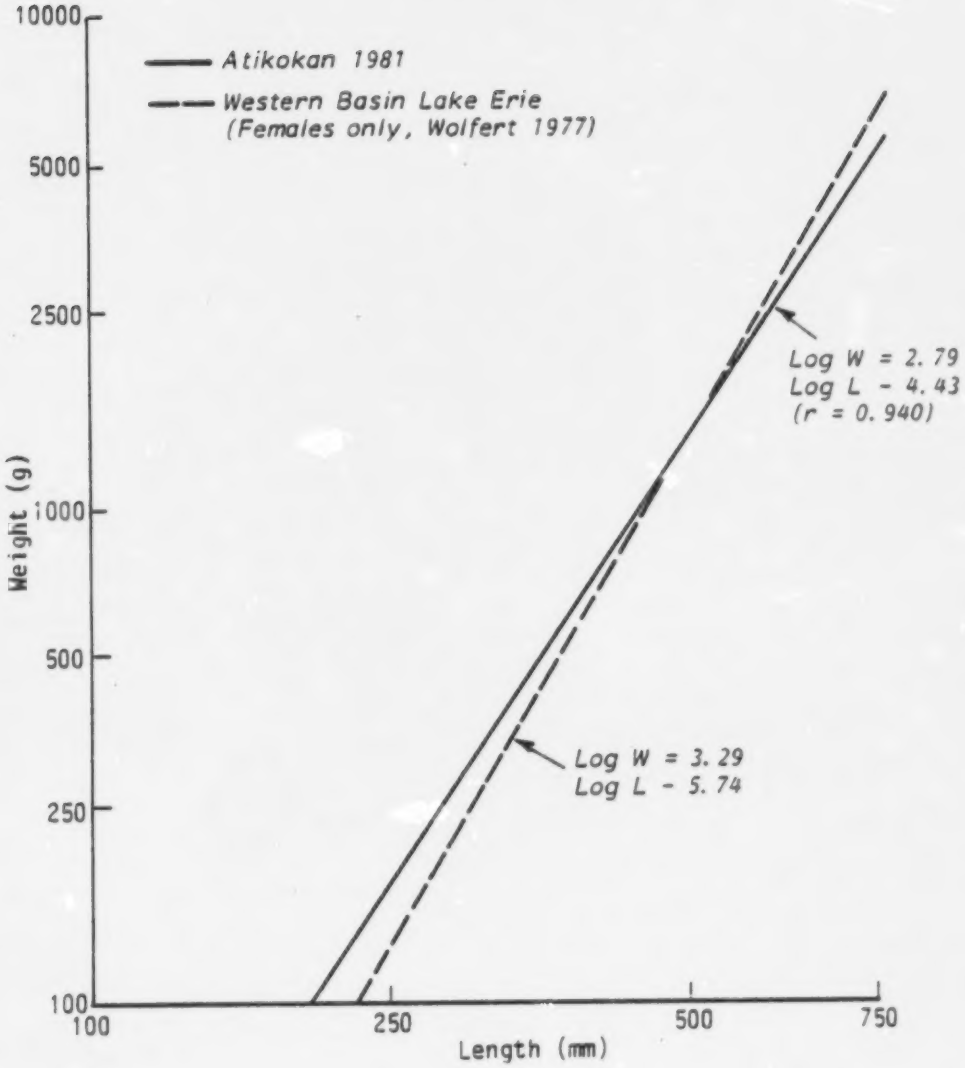


FIGURE 5-38

FORK LENGTH - WEIGHT RELATIONSHIP FOR WALLEYE ATIKOKAN 1981

158660-RD

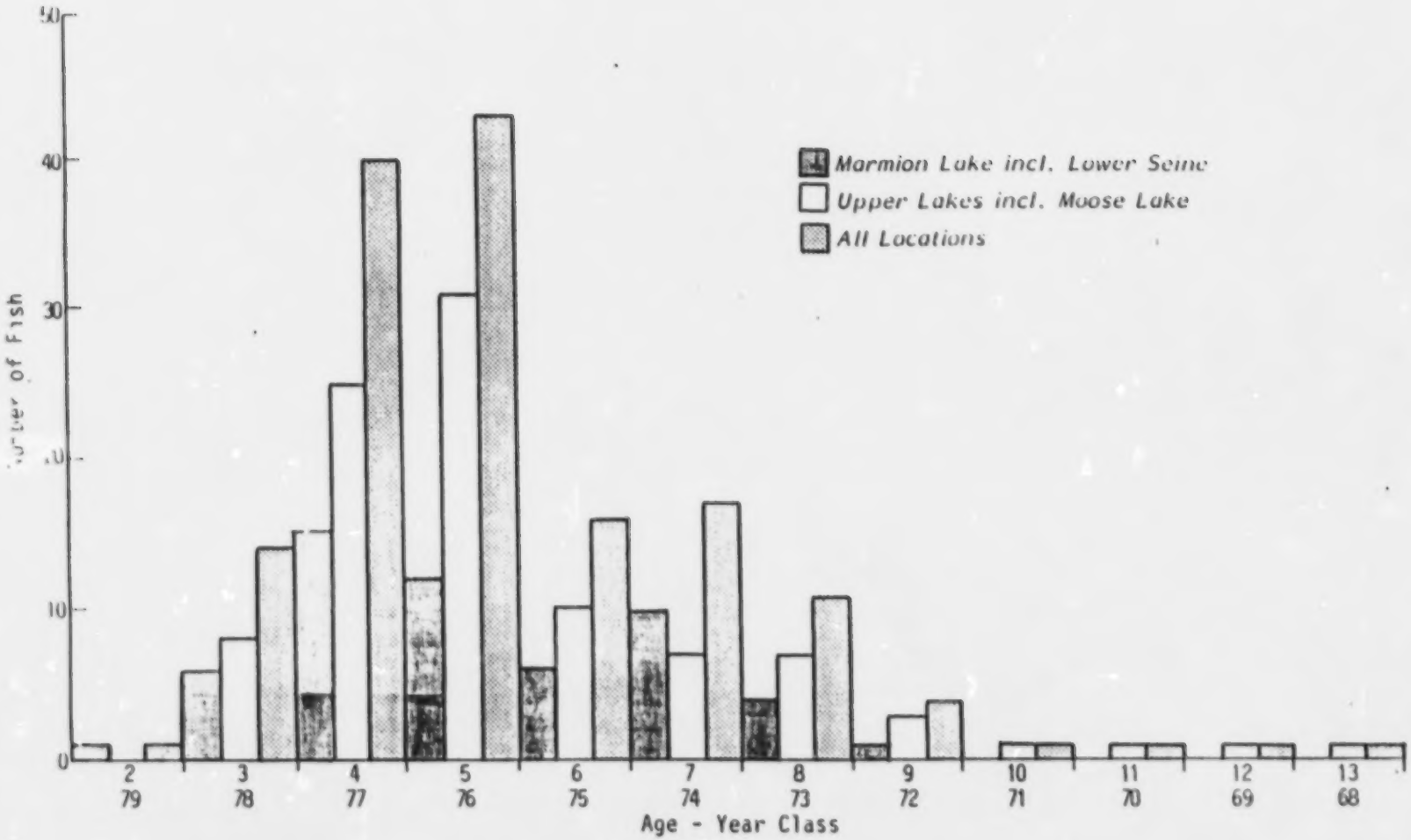


FIGURE 5 - 39

AGE DISTRIBUTION OF NORTHERN PIKE - ATIKOKAN 1981

Fork lengths of northern pike are given in Figure 5-40. The distribution of fork lengths with age was similar for pike from Marmion Lake and the upper lakes. Growth rate of northern pike decreases from south to north with a corresponding increase in longevity (Scott and Crossman 1973). The size with age of pike at Atikokan was greater than that reported by Miller and Kennedy (1948) for Lake Athabasca and Great Bear Lake and less than that reported by Wolfert and Miller (1978) for Lake Ontario. Similarly, the oldest fish caught at Atikokan (13) was intermediate between those caught by Miller and Kennedy (1948) (19) and Wolfert and Miller (1978) (10).

The weight-fork length relationship for northern pike is given in Figure 5-41. The regression equation was:

$$\log W = 3.15 \log L - 5.53$$

Coregonids

In 1981 two coregonids, lake whitefish and cisco, were identified at Atikokan. Lake whitefish were found in Moose, Snow, Abie and Marmion Lakes while cisco were reported from Icy, Abie and Marmion Lakes. Although not confirmed in 1981, lake whitefish were also found in Icy Lake in 1975 (Acres 1976). In addition, sampling in 1982 established the presence of cisco in Snow Lake. The presence of lake whitefish in Snow Lake was based on a single young of the year in a beach seine.

Coregonids are fall spawners that prefer cooler waters during the summer months, consequently lake whitefish and cisco are generally found below the thermocline during much of the summer. This preference to inhabit the hypolimnion during the summer can lead to large mortalities due to oxygen depletion (McCrimmon 1952). Evans (1978) discussed the importance of the combination of temperature and dissolved oxygen regimes on the "health" of lake whitefish in Lake Simcoe.

As a consideration of the potential for effects of oxygen depletion on the coregonids in the study area, Table 5-40 gives the minimum distance between the thermocline and the area of low (<2 ppm) oxygen concentration (June through September) as the limit of the distribution of coregonids in the water column during the summer. On the basis of this criterion, coregonids in Snow, Icy and Abie Lakes had the most restricted range in the system and consequently they may be assumed to be most likely to suffer from some form of oxygen or temperature stress during the summer. For cisco, an avoidance of reduced oxygen concentrations has been indicated (Evans 1978). This vertical avoidance, however, would move the fish from their preferred temperature of about 10°C (Engel and Magnuson, 1976).

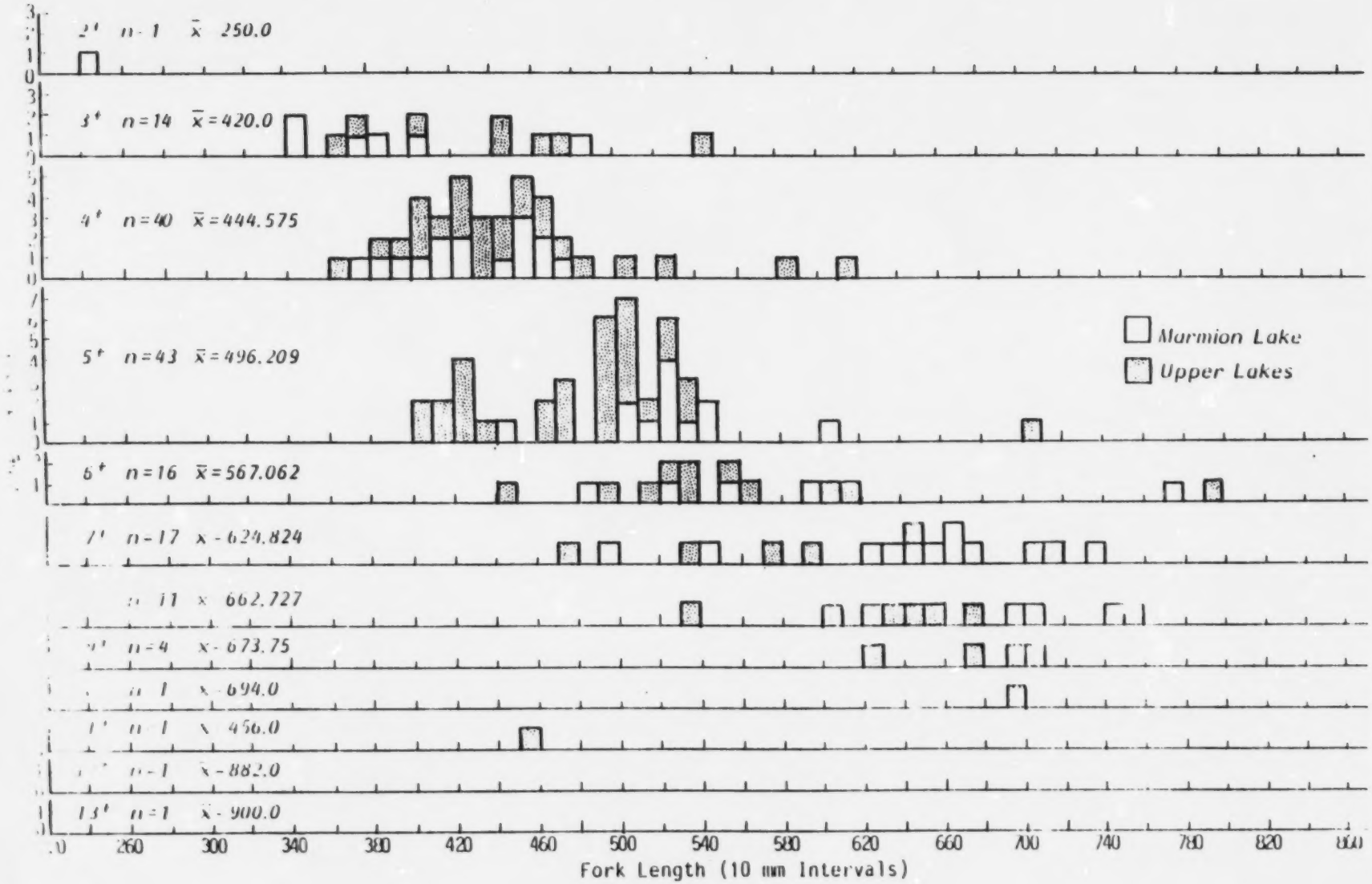


FIGURE 5-40

AGE - LENGTH HISTOGRAM OF NORTHERN PIKE
ATIKOKAN 1981

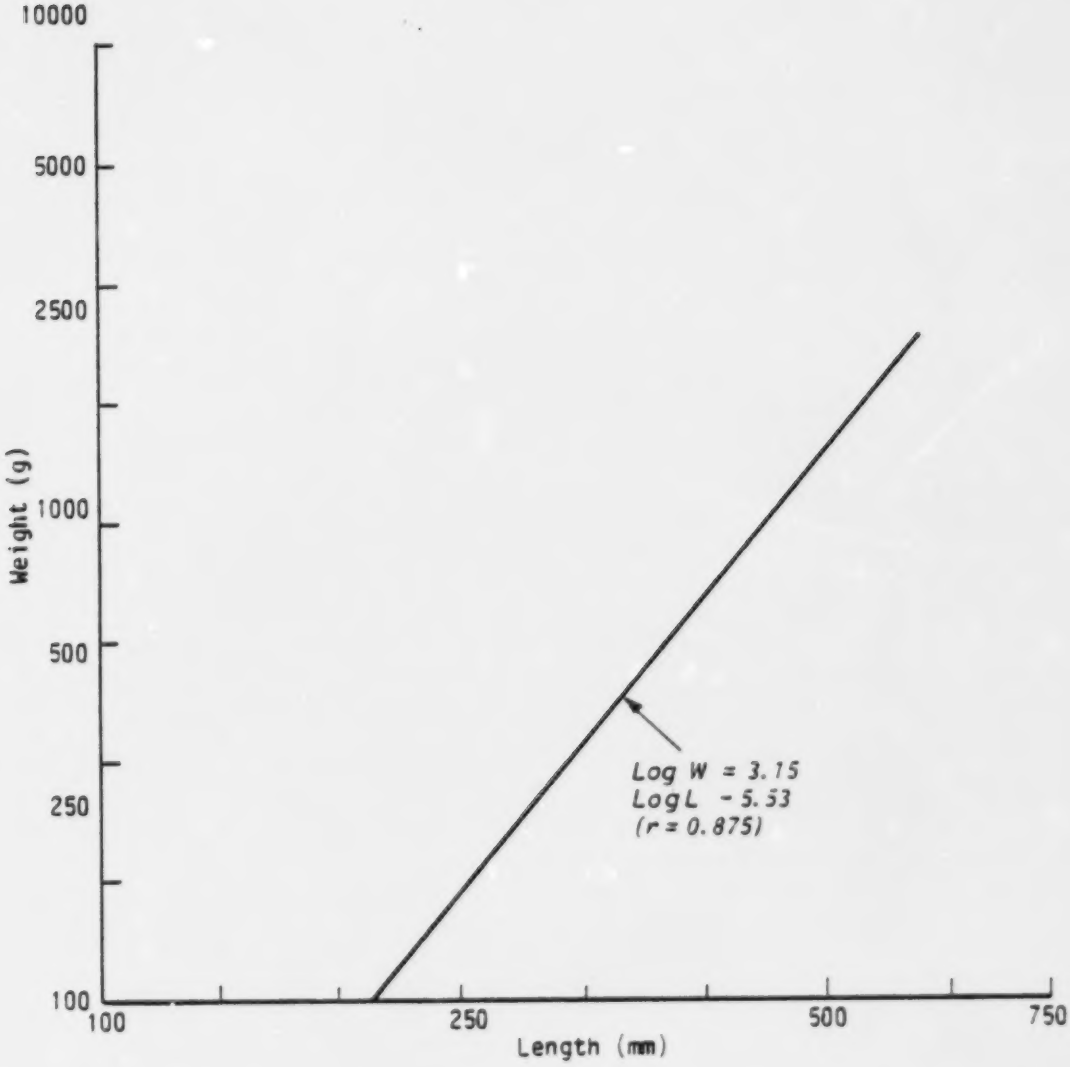


FIGURE 5-41

LENGTH-WEIGHT RELATIONSHIP
OF NORTHERN PIKE - ATIKOKAN 1981

159653-RD

The age distribution of lake whitefish caught in 1981 is given in Figure 5-42. The strongest year-class was 1972 (age 9+). Fork-lengths of lake whitefish at age are presented in Figure 5-43. The mean fork-lengths of whitefish from Atikokan were intermediate between those from Lake Ontario (Christie 1963) and Georgian Bay (Cucin and Regier 1965) and those from Lac la Ronge, Saskatchewan (Qadri, 1968).

The length-weight relation for whitefish caught at Atikokan is illustrated in Figure 5-44 and described by the equation:

$$\log W = 3.08 \log L - 5.05$$

TABLE 5-40

COMPARISON OF THE DEPTH (m) OF THERMOCLINE AND DEPTH OF OXYGEN DEPLETION ATIKOKAN, JUNE TO SEPTEMBER, 1981

Location	Depth of Thermocline	Minimum Depth of Reduced (<2 ppm) Oxygen	Difference
Snow Lake	6-7	8	1-2
Icy Lake	7-8	7	0
Abie Lake	5-7	5-7	0-2
Slush Lake	6	13	7
Marmion South	7-9	13	4-6
Marmion Central	7	12	5
Marmion North	7	13	6
Anderson Dam	5-8	9	1-4
Lower Seine	7-8	13	5-6
Moose Lake	6	10	4

6.0 CONCLUSIONS

1. Substrates in the lakes generally vary from boulder, cobble and bedrock near shore to fine organic sediments at deeper depths.

2. All of the lakes in the study area were dimictic with summer and winter thermal stratification and associated hypolimnetic oxygen depletion.

3. In general the basins samples were slightly acidic or neutral with relatively low alkalinities and moderate nutrient levels. Surface waters at Icy Lake and Anderson

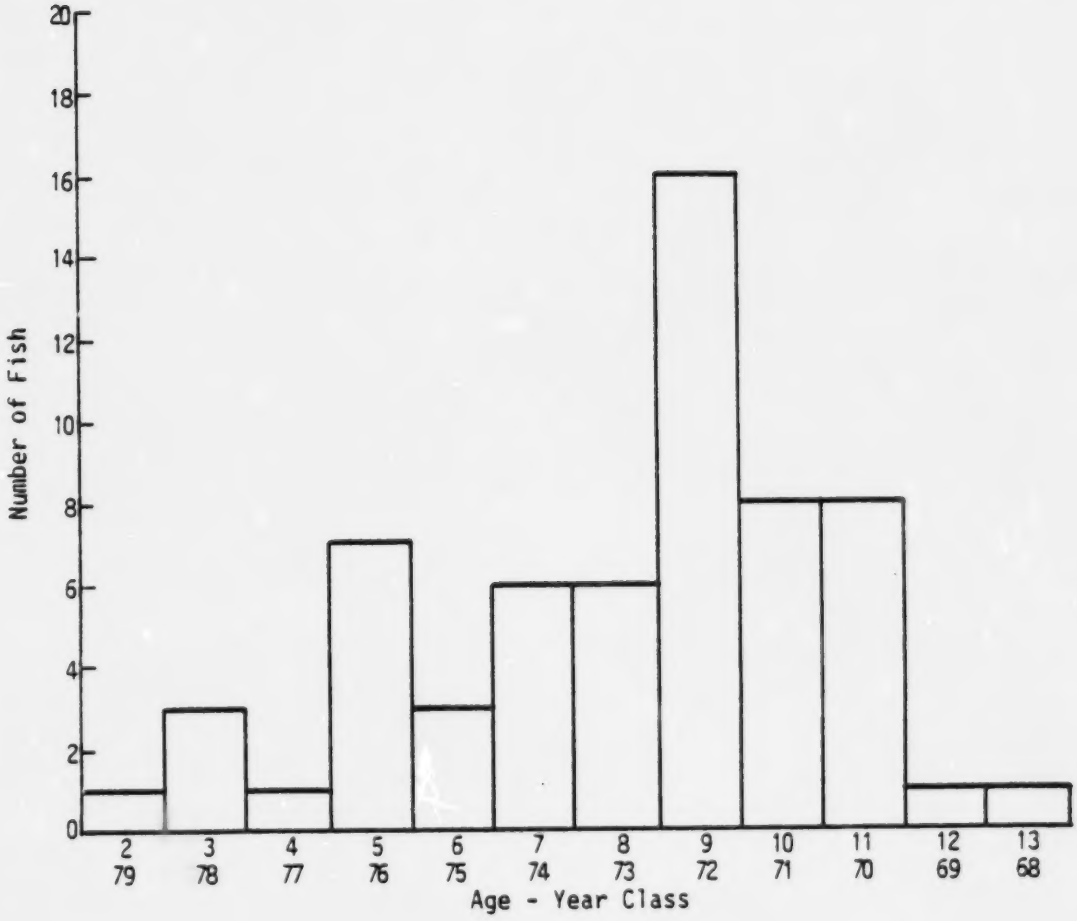


FIGURE 5 - 42

AGE DISTRIBUTION OF LAKE WHITEFISH
ATIKOKAN 1981

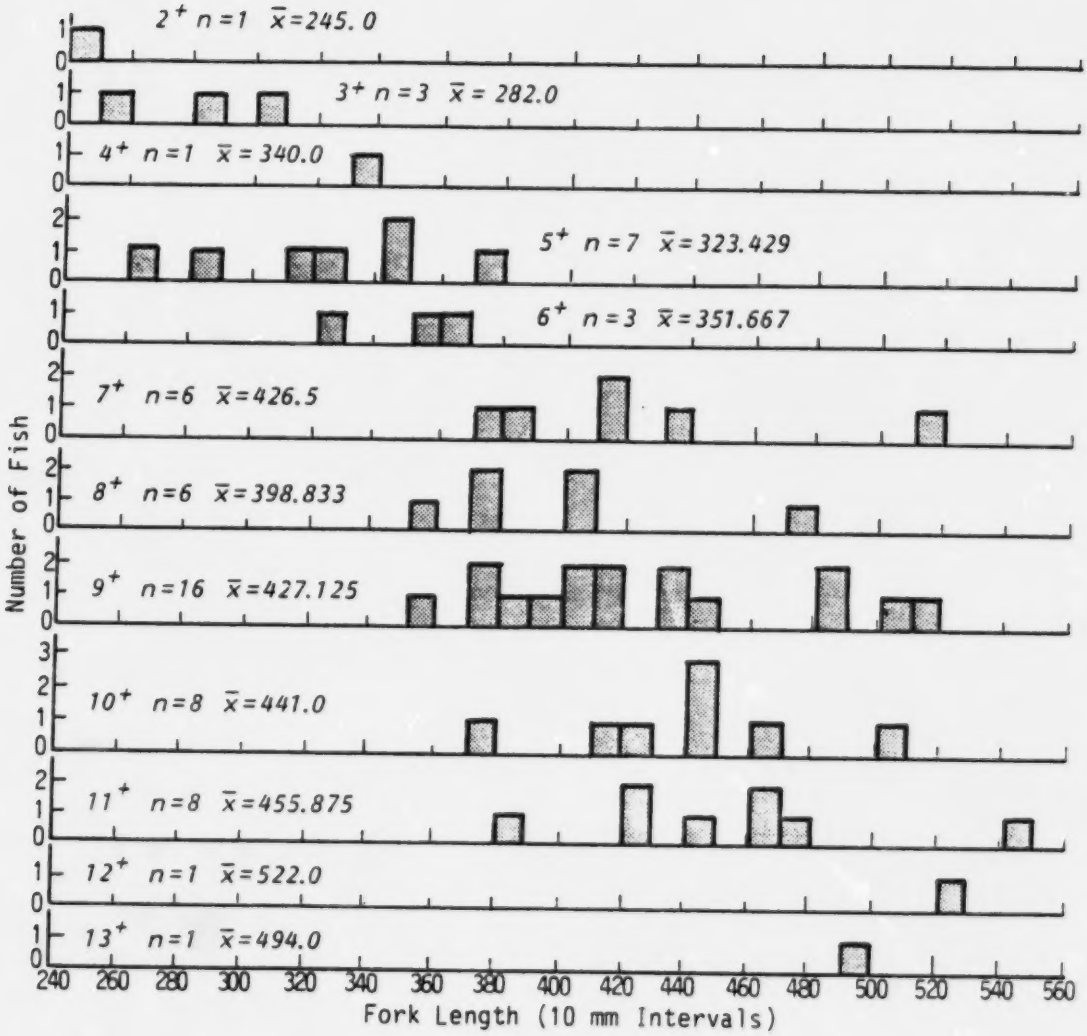


FIGURE 5-43
AGE VS FORK LENGTH HISTOGRAM FOR WHITEFISH
ATIKOKAN 1981

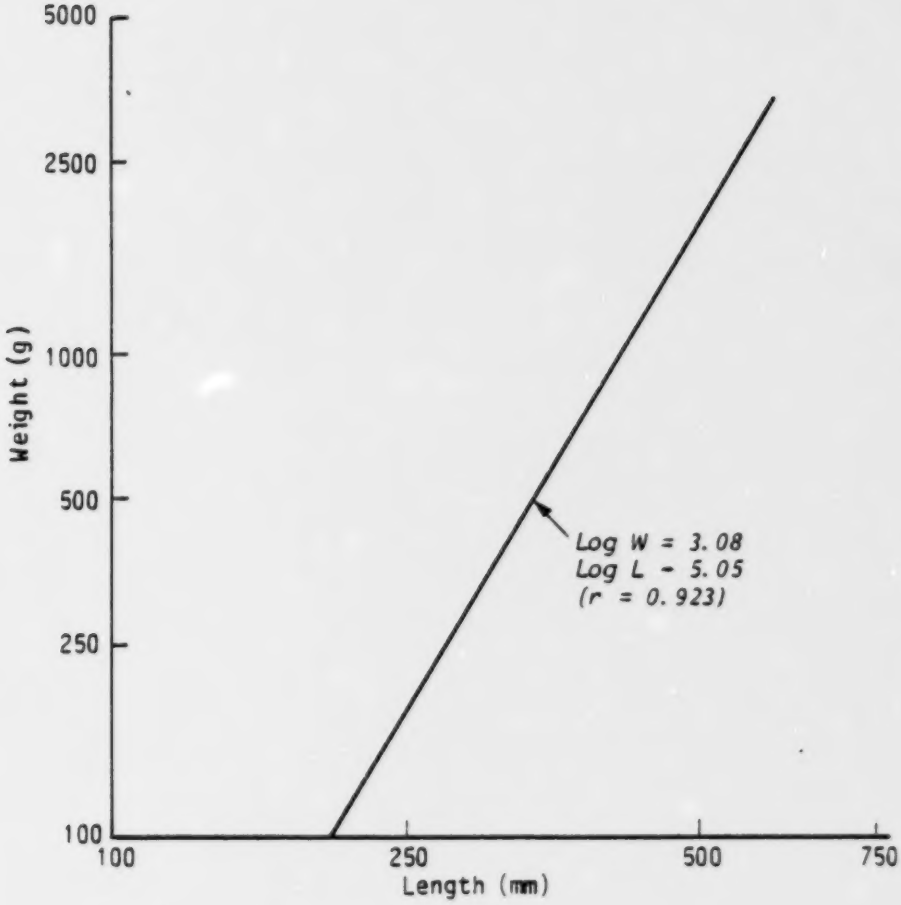


FIGURE 5-44

WEIGHT - LENGTH RELATIONSHIP OF
LAKE WHITEFISH - ATIKOKAN 1981

Dam were higher in nutrients and some other parameters. In addition, Anderson Dam had higher levels of some metals, iron, aluminum, manganese and mercury. In contrast, Slush Lake had lowest levels of nutrients.

4. Magnesium, iron, aluminum and nickel were higher in sediments from Marmion Lake than from the upper lakes. Manganese levels in sediments from Moose Lake were relatively high.

5. Attached algae did not appear to be an important component of the aquatic vegetation in the study area. Macrophytes, however, were widely distributed through the study lakes. Soft water species as well as those associated with hard water were identified which probably reflects the variable bedrock geology of the area. *Elodea canadensis*, a potentially problematic macrophyte, which may increase in abundance during operation of the station was present through most of the study area. Macrophytes were considered to be dense enough in a number of bays to constitute an impediment to recreation (swimming and boating).

6. Phytoplankton was dominated by flagellates with substantial representation by the diatoms and blue-green algae. Spatial variation in the composition and biomass of the phytoplankton was substantial. Moose Lake which was dewatered in 1981 was most different from the other lakes in composition with blue-green algae dominating. The Marmion Lake sampling locations, excluding Anderson Dam, generally had higher algal biomass.

7. Many rotiferan species identified in the zooplankton were typical of temperate oligotrophic lakes and similar to those found in the ELA lakes. *Keratella cochlearis*, *Kellicottia longispina* and *Polyarthra* were the main species. Highest densities were present in the spring and fall. Icy Lake, Marmion Lake South and Lower Seine Lake tended to contain the largest densities of rotifers. Spatial and temporal variation in the densities of crustacean zooplankton were high. *Diacyclops bicuspidatus thomasi* and *Diaptomas oregonensis* were the most common species.

8. Three types of benthic faunas were found, those characteristic of the Marmion Lake Basin, those characteristic of the small lakes in the circuit, and the fauna unique to Moose Lake.

   Variations observed within each faunal type could be related to depth, substrate and amount of oxygen present. The littoral zone of Marmion Lake displayed a high taxonomic diversity of insects, mollusks and crustaceans while the profundal zone was characteristized almost exclusively by the diptera.

   Moose Lake was very species poor and it was postulated that this was caused by the drawdown resulting in increased fish predation. The faunas of the small lakes in the circuit were of the type expected in dystrophic-mesotrophic lakes, while Marmion Lake proper exhibited more eutrophic characteristics.

9. Twenty-three fish species were identified in the study area, twenty-two of which were observed in Marmion Lake. The lakes appeared to be best distinguished by the contributions of white sucker and cisco. The upper chain lakes and Anderson Dam had relatively high catches of white sucker and low catches of cisco while the remaining Marmion Lake and Lower Seine locations had relatively large catches of cisco and low catches of white sucker.

   Walleye were present in all lakes except Snow, Slush and Fotheringham. Spawning occurred in late April and early May at all locations previously identified except North Twin Lake. The spawning areas were characterized by coarse substrates (cobble-gravel) with some current. Some walleye move from Marmion Lake into Abie Lake to spawn. Larval walleye were caught only in areas adjacent to the spawning beds with the exception of Anderson Dam. After spawning walleye moved offshore and large pelagic individuals were identified in water depths up to 15 m.

   Northern pike were identified in all of the study lakes. Spawning occurred in the second and third week of May in 10-14°C water. Pike appear to be relatively sedentary and were probably associated with near shore aquatic vegetation or other cover.

Fall spawning coregonids were found through most of the cooling circuit. In the smaller lakes anoxia in a large portion of the hypolimnion in the summer may severely restrict the vertical distribution of coregonids. The growth rates of walleye, northern pike and lake whitefish were intermediate between those of more northerly and southerly latitudes.

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APPENDIX I

PARTICLE SIZE DISTRIBUTIONS (%) OF SUBSTRATE SAMPLES

Sample No	Basin	Depth (m)	Particle Sizes (mm)							
			<2.0	1.0–2.0	0.5–1.0	0.25–0.5	0.125–0.25	0.063–0.125	0.038–0.063	<0.038
1a	Marmion Lake	1	69.02	14.15	10.77	3.62	1.01	0.27	0.24	0.93
1b	Marmion Lake	3	0.20	0.01	0.08	0.10	0.61	1.23	1.36	96.42
4a	Marmion Lake	0	0.02	0.08	0.42	0.89	7.27	21.21	44.07	26.04
4b	Marmion Lake	1	1.60	3.72	9.30	27.04	38.26	8.76	6.21	5.12
5a	Marmion Lake	0	4.43	5.75	15.42	17.60	16.76	10.06	7.34	22.43
5b	Marmion Lake	0.5	0.75	1.43	21.71	51.27	13.34	5.66	2.54	3.31
5c	Marmion Lake	4	0.03	0.08	0.17	1.01	7.30	38.87	19.94	32.61
7	Marmion Lake	7	22.18	2.43	2.98	2.98	4.23	5.73	5.93	53.34
9a	Marmion Lake	2	26.68	11.72	13.82	22.39	16.84	4.19	1.86	2.51
11a	Marmion Lake	2	60.61	12.70	13.03	8.26	3.73	0.78	0.22	0.61
11b	Marmion Lake	4	9.64	3.33	5.95	8.00	34.30	8.42	11.14	19.22
12a	Marmion Lake	3	52.73	13.49	10.89	11.16	7.01	1.47	0.91	1.53
13a	Marmion Lake	2	42.71	26.70	14.67	8.29	4.75	1.37	0.34	0.77
13b	Marmion Lake	3	33.64	3.35	4.64	4.34	7.96	8.29	14.36	23.19
15a	Marmion Lake	0.5	72.53	5.67	7.48	6.37	3.80	1.63	1.07	1.44
18a	Marmion Lake	9	2.29	1.69	2.06	3.79	21.87	13.11	13.08	42.10
19a	Marmion Lake	8	0.25	0.0	8.12	37.31	28.83	10.00	5.81	9.69
20a	Marmion Lake	1	15.62	10.96	34.36	26.05	10.52	1.25	0.48	0.76
23a	Lower Seine	2.5	46.36	4.79	5.95	10.91	13.19	7.93	4.36	4.51
25a	Lower Seine	2	32.52	14.94	10.59	9.68	15.99	7.85	2.69	5.73
25b	Lower Seine	4	18.98	3.82	6.95	9.21	12.84	18.06	16.35	13.98
27a	Lower Seine	4	45.32	5.32	5.11	6.61	15.64	3.88	7.42	10.70
28a	Lower Seine	2.5	22.55	18.34	20.20	22.37	11.60	1.88	1.03	2.03
30a	Marmion Lake	1.5	70.15	11.46	8.53	5.26	2.23	0.61	0.48	1.27
33a	Marmion Lake	2	14.94	5.68	7.51	12.85	20.93	8.86	8.29	20.95
35a	Marmion Lake	2	37.93	13.81	14.29	12.15	10.89	4.69	2.32	4.23
38a	Marmion Lake	4	29.62	2.20	5.52	7.71	12.00	14.70	15.11	13.15
41a	Snow Lake	7	0.43	0.61	2.31	33.02	30.37	14.93	8.63	9.70
43a	Snow Lake	1.5	15.14	9.75	22.68	33.04	14.28	2.64	0.80	1.67
44a	Icy Lake	0.5	11.11	2.60	5.87	12.40	15.93	12.81	13.48	25.80
45a	Icy Lake	7	0.0	0.12	6.84	23.54	29.17	18.76	10.42	11.14
46a	Icy Lake	3	56.80	9.35	16.42	13.68	2.99	0.45	0.15	0.15
46b	Icy Lake	0	21.93	10.21	19.85	23.64	17.94	4.16	0.67	1.61
47a	Icy Lake	0	3.32	1.11	3.13	6.74	5.76	8.04	25.84	46.03
48a	Icy Lake	8	0.07	0.10	2.62	24.72	31.47	20.50	10.47	10.04
51a	Slush Lake	5	0.01	0.16	1.28	53.32	17.71	14.09	3.55	7.89
53a	Marmion Lake	2	14.60	6.00	16.68	33.08	21.59	3.74	1.74	3.07
56a	Marmion Lake	0	24.90	9.02	5.89	12.73	27.25	12.73	2.92	4.57

APPENDIX 2

MONTHLY TEMPERATURE AND DISSOLVED OXYGEN PROFILES — ATIKOKAN GS 1981

Basin	Depth m	Temperature °C June	July	Aug	Sept	Oct	Nov	Feb	Dissolved Oxygen ppm July	Aug	Sept	Oct	Nov	Feb
Marmion N.	surf	16	20.8		18.2	12.4	4.3	-	7.6		8.6	8.4	11.5	-
	1	16	20.8		18.1	12.4	3.9	3.7	7.5		8.3	8.6	11.5	12.4
	2	16	20.8		18.1	12.4	3.9	2.6	7.6		8.2	8.4	11.5	11.4
	3	16	20.7		18.0	12.2	3.9	2.8	7.6		8.2	8.5	11.5	11.2
	4	16	20.6		18.0	12.2	3.9	3.1	7.6		8.1	8.3	11.5	11.1
	5	14	20.6		18.0	12.2	3.9	3.2	7.5		8.0	8.3	11.5	10.8
	6	12	20.3		27.9	12.2	3.9	3.3	6.4		8.0	8.3	11.5	10.5
	7	11	16.8		16.7	12.2	3.9	3.4	3.8		4.5	8.3	11.5	10.0
	8	10	14.2		14.7	12.2	3.9	3.6	3.0		1.3	8.2	10.9	9.1
	9	9	12.8		13.3	12.2	3.9	3.6	3.4		1.2	8.2	10.9	8.3
	10	8	11.2		11.8	12.2	3.9	3.8	3.9		1.4	8.2	10.9	7.0
	11	8	9.7		11.8	12.2	3.9	3.9	4.1		1.4	8.1	10.9	6.2
	12	8	9.1		9.2	9.9	3.9	4.3	4.2		1.6	1.2	10.9	3.3
	13	7	8.1		7.4	8.1	3.7	4.3	3.3		0	0	10.9	2.3
	14	7	7.5		7.4	7.3	3.8	4.4	0		0	0	10.9	2.3
	15	7	7.2		7.3		3.8	4.4	0		0	0	10.9	2.0
	16	7					3.9						10.5	
	17	7					3.9						10.5	
	18	6.6												
Marmion C	surf	17	21.0	22.0	17.9	12.4	3.8	3.5	7.9		8.5	9.1	11.9	13.6
	1	16	20.9	21.5	17.8	12.4	3.8	2.1	7.9		8.5	9.0	11.9	11.9
	2	16	20.8	21.5	17.9	12.3	3.7	2.5	7.9		8.6	9.0	11.9	11.7
	3	16	20.7	21.2	17.8	12.3	3.7	2.6	7.9		8.5	9.1	11.9	11.8
	4	14	20.7	21.2	17.7	12.3	3.7	2.8	7.9		8.4	9.0	11.9	10.8
	5	16	20.6	21.2	17.6	12.3	3.7	2.9	8.0		8.4	8.9	11.1	10.2
	6	16	18.0	18.0	17.5	12.3	3.7	3.1	4.8		8.3	8.9	11.1	10.0
	7	10	15.3	14.5	17.4	12.2	3.7	3.3	4.0		8.2	8.9	11.1	8.9
	8	10	14.0	13.5	16.6	12.2	3.7	3.4	3.5		5.9	8.9	11.1	8.3
	9	10	13.2	13.0	15.3	12.2	3.7	3.4	3.0		3.4	8.9	11.1	7.6
	10	9	12.8	12.5	14.3	12.2	3.7	3.7	2.7		1.4	8.9	11.1	6.8
	11	9	12.0	11.5	13.3	12.2			2.0		0.2	9.8		
	12	9	11.4	11.5	11.8	12.2			2.2		0	9.9		
	13	9	10.9	10.5	11.5	12.2			1.5		0	8.9		
	14	8		9.9										
	15			9.0										
	16			8.0										
Marmion S	surf	18	21.1	21.7	17.7	12.2	4.1	0.2	8.1		8.4	8.9	11.3	13.3
	1	17	20.9	21.8	17.7	12.4	4.1	1.8	8.0		8.4	8.8	11.3	11.9
	2	17	20.6	21.9	17.7	12.4	4.1	2.1	8.0		8.4	8.9	11.3	11.2
	3	17	20.5	21.8	17.6	12.4	4.0	2.1	9.0		8.3	7.5	11.3	10.8
	4	17	20.2	21.8	17.4	12.4	4.1	2.3	7.9		8.1	9.0	11.3	10.6
	5	17	19.6	21.6	17.4	12.4	4.0	2.3	7.2		8.1	8.8	11.3	10.7
	6	17	16.5	21.5	17.4	12.4	4.0	2.5	5.3		8.1	8.9	11.3	10.3
	7	16	15.1	17.2	17.4	12.4	4.1	2.6	4.5		8.1	9.1	10.0	10.4
	8	13	13.6	15.2	17.4	12.4	4.1	2.9	3.4		7.1	9.1	10.0	9.2
	9	10	12.8	13.6	13.3	12.4	4.1	3.0	3.0		0.2	8.6	10.0	7.9
	10	9	12.1	13.2	12.1	12.3	4.1	3.2	2.7		0	8.5	10.0	7.4
	11	9	10.6	12.5	9.8	12.3	4.1	3.3	3.1		1.1	8.5	10.0	6.1
	12	8	8.8	12.0	8.7	11.2	4.1	3.4	3.5		1.1	4.1	10.0	5.0
	13	8	7.4	11.2	7.6	8.1	4.1	3.4	2.7		0	0.8	10.0	3.6
	14	6	6.8	10.8	6.9	6.7	4.1	3.5	1.9		0	0	10.0	2.3
	15	6	6.4		6.4	6.0	4.1	3.5	0		0	0	8.9	0
	16	6	6.6		8.8	5.7	4.1	3.4	0		0	0	8.9	0
	17	5.8			5.6	5.4	4.1		0		0	0	8.9	
	18	5.6							0					
Anderson Dam	surf	18	20.4		17.8	11.6	2.8	1.2	7.4		8.6	10.6	12.1	12.3
	1	17	20.4		17.8	11.6	2.7	2.1	7.4		8.5	9.8	12.1	11.1
	2	17	20.4		17.7	11.6	[illegible]	2.6	7.4		8.4	9.6	12.1	10.8
	3	17	20.3		17.5	11.5	2.7	2.7	7.4		8.4	9.4	12.1	9.8
	4	16	20.3		17.5	11.5	2.7	2.9	7.4		8.3	9.4	12.1	8.5
	5	13	19.7		17.4	11.4	2.7	3.0	5.3		8.3	9.4	12.1	7.8
	6	12	17.4		17.4	11.4	2.7	3.2	1.6		8.2	9.4	12.1	7.8
	7	12	14.6		17.6	11.4	2.7	3.2	0.9		7.4	9.5	12.0	7.2
	8	11	13.3		13.6	11.4	2.7	3.3	0.2		0.1	9.4	12.0	6.9
	9	10	11.4		11.9	11.4	2.7	3.3	0		0	9.4	12.0	5.9
	10	10	10.9			11.3	2.7	3.7	0			9.4	12.0	4.4
	11	10	10.5			11.2	2.7		0			9.4	12.0	
	12						2.7						10.9	
Able Lake	surf	18	21.5	22.5	18.4	11.9	2.9	0.5	8.1		8.6	9.8	11.8	9.7
	1	18	21.5	22.2	18.2	11.8	2.9	1.9	8.0		8.6	9.5	11.8	9.1
	2	18	21.4	22.2	18.1	11.8	2.8	1.9	8.0		8.6	9.4	11.8	9.1
	3	18	21.1	22.0	17.9	11.6	2.8	2.2	8.0		8.5	9.8	11.8	8.9
	4	17	21.0	21.5	17.8	11.7	2.8	2.3	8.0		8.5	9.7	9.5	7.1
	5	12	16.7	16.0	17.6	11.7	2.8	2.9	7.1		8.4	9.5	9.5	5.5
	6	9	13.2	12.8	17.5	11.7	2.8	2.9	3.4		8.3	9.3	9.5	5.1
	7	8	10.8	11.2	11.0	11.7	2.8	2.9	3.0		0	9.2	9.5	5.5
	8	8	9.5	9.0	9.7	11.6	2.8	2.8	0		0	9.2	9.5	5.1
	9	7	8.6	8.8		11.5	2.8	3.1	0			7.3	9.5	0
	10	7		8.5			2.8	3.0					9.5	0

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APPENDIX 2 (Cont'd)

Basin	Depth m	Temperature °C							Dissolved Oxygen ppm					
		June	July	Aug	Sept	Oct	Nov	Feb	July	Aug	Sept	Oct	Nov	Feb
Icy Lake	surf	18	21.1	21.0	17.8	10.1	3.1	1.1	7.7		8.7	8.7	11.5	10.2
	1	18	21.1	21.0	17.8	10.1	3.1	2.1	7.7		8.6	8.7	11.5	9.3
	2	18	21.1	21.0	17.8	9.7	3.1	2.4	7.7		8.6	8.3	11.5	9.0
	3	18	21.1	21.0	17.7	9.6	-3.1-	2.4	7.7		8.6	8.3	11.5	7.7
	4	17	21.1	21.0	17.7	9.5	3.1	2.7	7.7		8.6	8.4	10.7	7.1
	5	11	18.2	18.5	17.7	9.5	3.1	2.8	6.5		8.6	8.3	10.7	6.4
	6	9	14.1	15.5	17.7	9.5	3.1	2.9	2.3		8.5	8.3	10.7	6.0
	7	8	11.1	15.0	14.0	9.4	3.0	2.9	0		2.5	8.3	10.7	5.4
	8	7	9.1	11.5	10.5	9.4	3.0	2.9	0		0	7.9	10.7	4.9
	9	6	7.6	9.0	7.7	9.1	3.1		0		0	7.6	10.7	
	10	6	7.1	8.0					0					
Snow Lake	surf	18	21.8		8.4	9.9	3.1	1.3	7.6		8.8	9.2	11.8	10.8
	1	18	21.6		18.2	9.7	3.1	2.8	7.6		8.8	9.3	11.8	9.4
	2	18	21.6		17.8	9.5	3.1	3.2	7.6		8.8	9.0	11.8	8.0
	3	17	20.7		17.7	9.4	3.1	3.2	7.6		8.7	8.9	11.8	7.8
	4	-16-	20.5		17.5	9.3	3.1	3.3	7.6		8.6	8.9	11.8	7.4
	5	16	16.9		17.4	9.3	3.1	3.3	8.6		8.4	9.0	10.0	7.2
	6	11	11.9		15.5	9.2	3.1	3.6	7.3		6.6	9.3	10.0	4.3
	7	8	8.9		10.8	9.1	3.2	3.7	4.3		2.1	9.0	10.0	3.2
	8	7	7.8		9.0	9.1	3.2	3.7	2.6		0	9.0	10.0	3.5
	9	6	6.9		7.7		3.1		0		0		9.9	
	10	6	6.4		7.4				0		0			
	11		6.2						0					
Slush Lake	surf		21.4		18.0	10.2	4.2	2.0	7.4		9.4	10.2	10.3	10.6
	1		21.4		18.0	10.1	4.2	3.2	7.4		9.4	9.8	10.3	8.8
	2		21.3		18.0	9.9	4.2	3.3	7.5		9.3	9.7	10.3	8.8
	3		21.2		18.0	9.9	4.2	3.4	7.5		9.3	9.7	10.3	8.9
	4		20.6		18.1	-9.8-	4.2	3.4	7.7		9.3	9.7	10.3	8.8
	5		17.6		18.0	9.8	4.2	3.4	10.4		9.2	9.6	10.3	8.7
	6		11.0		11.4	9.8	4.2	3.5	11.0		11.2	9.6	10.3	8.4
	7		9.2		11.1	9.8	4.2	3.5	11.2		12.3	9.6	10.3	8.0
	8		7.2		8.5	9.8	4.2	3.6	11.0		11.0	9.3	9.1	7.6
	9		6.1		7.0	9.6	4.2	3.6	8.5		8.3	8.6	9.1	7.5
	10		5.9		6.3	6.8	4.2	3.8	6.5		4.4	3.6	9.1	6.8
	11		5.6		5.9	6.0	4.2	3.8	4.5		2.5	1.8	9.1	4.4
	12		5.4		5.8	6.0	4.2	3.9	2.5		1.9	1.6	9.1	3.1
	13		5.3		5.6	5.8	4.1	4.0	0		1.5	0	9.1	3.0
	14		5.1		5.5	5.6	4.1	4.0	0		0	0	9.1	3.0
	15		4.9		5.0	5.1	4.1	4.0	0		0	0	9.1	0.0
	16		4.7		4.8	4.7	4.1		0		0	0	8.9	
	17		4.7		4.7	4.5	4.1		0		0	0	8.9	
Moose Lake	surf	20	21.1		17.1	9.9	4.0	2.7	7.9		9.7	9.6	10.3	14.4
	1	20	21.0		17.1	9.9	4.0	3.5	7.9		9.4	9.6	10.3	9.3
	2	19	20.6		17.1	9.9	4.0	3.6	7.9		9.3	9.5	10.3	9.0
	3	17	20.2		17.1	9.9	4.0	3.7	7.8		9.2	9.5	10.3	8.8
	4	13	18.		17.1	9.3	4.0	3.7	6.7		9.2	9.4	10.3	8.3
	5	9	14.1		17.1	9.3	4.0	3.7	5.7		9.2	9.2	10.3	8.5
	6	7	9.8		11.9	9.2	4.0	3.7	4.1		5.2	9.2	10.3	8.5
	7	6	6.6		8.5	9.1	4.0	3.7	3.1		5.5	9.1	10.3	8.5
	8	6	5.7		6.8	9.1	4.0	3.7	2.7		4.6	9.0	10.3	8.5
	9	5	5.2		5.8	8.9	4.0	3.7	2.9		2.3	7.2	10.3	8.5
	10	5	5.0		5.4	6.5	4.0	3.7	2.4		0	2.3	10.3	8.2
	11	5	4.8		4.9	5.0	4.0	3.7	2.1		0	0	10.3	8.2
	12	5	4.7		4.8	4.9	4.0	3.8	1.8		0	0	9.7	9.0
	13	5	4.6		4.6	4.7	4.0	3.8	1.8		0	0	9.7	7.7
	14	5	4.6		4.6	4.6	4.0	3.8	0		0	0	9.7	7.4
	15	5	4.6		4.6	4.4	4.0	3.8	0		0	0	9.7	7.1
	16	4	4.6		4.5	4.4	4.0	3.8	0		0	0	9.7	7.0
	17	4	4.6		4.5	4.5	4.0	3.8	0		0	0	9.7	6.6
	18	4	4.6		4.5	4.5	4.0	3.8	0		0	0	9.7	6.5
	19	4	4.7		4.5	4.5	4.0	3.9	0		0	0	9.7	6.0
	20	4	4.6		4.5	4.4	4.0	3.9	0		0	0	9.7	5.6
	21	4	4.6		4.5	4.4	4.0	3.9	0		0	0	9.7	5.0
	22	4	4.6		4.5	4.4	4.0	3.9	0		0	0	9.7	4.6
	23	4	4.6		4.5	4.4	4.0	3.9	0		0	0	9.7	4.0
	24	4	4.6		4.5	4.4	4.0	4.0	0		0	0	9.7	3.0
	25	4	4.6		4.4	4.4	4.2	4.0	0		0	0	9.3	2.6
	26	4	4.6		4.4	4.4	4.2	4.1	0		0	0	9.0	2.5
	27	4			4.4	4.4	4.1	4.1			0	0	9.0	0
	28	4						4.1						0
	29	4						4.1						0
	30	4						4.1						0
Lower Seine	surf	17	21.1	21.9	18	12.0	4.2	3.9	7.9		9.4	9.4	11.4	12.4
	1	17	21.1	21.8	17.9	12.1	4.1	2.6	7.9		9.4	9.3	11.4	10.6
	2	17	21.0	21.6	17.9	12.1	4.2	2.8	7.9		9.4	8.8	11.4	10.5
	3	17	20.9	21.5	17.9	12.0	-4.2-	3.1	7.8		9.4	8.5	11.4	10.9
	4	17	20.8	21.2	17.8	12.0	4.2	3.1	7.8		9.3	8.5	11.4	10.2
	5	16	20.7	20.5	17.7	12.0	4.2	3.3	7.8		9.2	8.5	11.4	10.0
	6	13	20.3	18.5	17.7	12.0	4.2	3.4	7.1		9.1	8.4	11.4	9.8
	7	10	14.4	15.0	17.4	12.0	4.2	3.4	4.6		7.6	8.4	8.5	9.8
	8	9	13.0	12.5	14.0	12.0	4.2	3.4	4.1		1.5	8.4	8.5	9.2
	9	9	11.3	11.0	11.7	12.0	4.2	3.5	4.3		1.9	8.4	8.5	8.8
	10	8	10.0	9.2	10.4	12.0	4.2	3.6	4.2		2.3	8.4	8.5	8.3
	11	8	8.4	8.8	8.7	11.7	4.2	3.6	4.3		2.3	6.7	8.5	7.5
	12	8	7.9	8.0	8.2	8.3	4.2	3.7	3.9		2.9	1.2	8.5	6.7
	13	7	7.6	8.0	7.7	7.7	4.2	3.7	3.3		2.6	0	8.5	6.4
	14	7	7.4	7.5	7.4	7.4	4.2	3.8	2.9		2.9	0	8.5	5.1
	15	7	7.2	7.5	7.1	7.0	4.2	3.9	2.2		0	0	8.5	4.1
	16	7	7.0	7.2	6.9	6.9	4.2	4.0	1.1		0	0	8.5	2.1
	17	6	6.8	7.1	6.8	6.6	4.2	4.2	0		0	0	8.5	0.0
	18	6	6.7	7.1	6.7	6.5	4.2	4.3	0		0	0	8.5	0.0
	19	6	6.6	7.1	6.5			4.3	0		0			0.0
	20	6	6.6						0					
	21	6												
	22	6												
	23	6												

APPENDIX 3

LEVELS OF WATER QUALITY PARAMETERS IN SURFACE AND BOTTOM SAMPLES TAKEN IN ICY LAKE, ATTIGHAN LS
PRECONSTRUCTION STUDY YEAR 1 - JUNE 1981 TO FEBRUARY 1982

Parameter	June 29		September 8		November 12		February 11	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
Turbidity NTU	1.8	2.5	1.1	4.3	1.2	1.2	1.5	1.2
Secchi Depth m	4.5		3.6		2.[illegible]			
Conductivity mho/m	13.2	14.2	13.0	13.3	14.7	14.4	12.1	13.1
Suspended Solids 105°C mg/l	<1	15	<1	1.2	1	1.2	<2	<2
550°C mg/l	<1	4	<1	1.2	0.8	0.8	<2	<2
Dissolved Solids 105°C mg/l	100	102	102	98	90	86	78	80
550°C mg/l	74	92	84	82	64	70	60	70
Odour	-		None	None	-	-	None	None
pH	7.2	6.8	6.4	6.3	6.8	7.2	6.7	6.9
Dissolved Oxygen mg/l	13.5[a]	1.2[a]	8.7	0.4	11.5[b]	10.7[b]	10.2	4.9[c]
Alkalinity (HCO_3) as $CaCO_3$ mg/l	63	57	61	67	63	63	51	65
Hardness ($CaCO_3$) mg/l	70	67	66	71	67	67	58	73
Calcium mg/l	23.7	20.0	20	22	20	20	18	22
Magnesium mg/l	4.7	4.2	3.9	4.2	4.2	4.2	3.1	4.4
Sodium mg/l	4.8	4.0	3.7	3.6	3.7	3.6	2.9	4.4
Sulphate (SO_4^{2-}) mg/l	6.8	5.3	4.6	4.0	5.0	5.1	4.8	5.7
Iron Suspended mg/l		0.71	0.015	0.041	0.017	0.049	0.096	0.030
Dissolved mg/l	<0.05	0.61	0.05	0.20	0.04	0.05	0.06	0.08
Nickel mg/l	<5	<5	<5	<5	<5	<5	<5	<5
Aluminum mg/l	<0.2	<0.2	0.2	<0.12	<0.15	<0.15	<0.2	<0.2
Copper mg/l	3	3	2	3	<1	<1	2	3
Zinc mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese mg/l	<0.05	1.31	0.07	0.32	0.05	0.05	<0.02	0.03
Mercury mg/l	<0.4	<0.4	0.4	0.4	0.2	<0.2	<0.2	<0.2
Total Organic Carbon mg/l	6.2	5.6	1.1	0.4	5.5	9.2	8	8
Total Inorganic Carbon mg/l	10.9	7.8	16.6	17.9	16.7	17.9	8	18
Chloride mg/l	4.7	4.7	4.7	4.8	4.4	4.3	3.3	5.2
Potassium mg/l	1.2	1.2	1.1	1.2	0.9	1.0	1.0	1.2
Total Phosphorus mg/l	16		16	19	12	17	8	5
Soluble Phosphorus mg/l	10	10	5	9	9	9	6	5
Particulate Phosphorus mg/l	6	8[d]	11	10	3	8	7	6
Total Kjeldahl Nitrogen mg/l	0.50	0.71	0.00	0.91	0.43	0.42	1	0.50
Soluble Nitrogen mg/l	0.40	0.66	0.36	0.58	0.35	0.36	1	0.41
Particulate Nitrogen mg/l	0.02	0.05	0.04	0.03	0.08	0.06	1	0.09
Nitrate (NO_3) mg/l	<0.01	0.15	<0.2	<0.2	0.11	0.11	0.31	1.05
Nitrite (NO_2) mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Silica mg/l	2.0	7.9	6.0	7.9	4.4	4.7	4.2	3.4
Soluble Silica mg/l	1.8	5.2	3.1	6.8	4.1	3.9	1.69	4.2
Ammonia (NH_3) mg/l	<0.04	0.20	0.04	0.04	0.01	0.01	0.01	0.01
Arsenic mg/l							0.001	0.001
Selenium mg/l							<0.001	<0.001

a) June 22, 1981
b) November 10, 1981
c) February 9, 1982
Not Analyzed

[illegible]

[illegible] WATER QUALITY PARAMETERS IN SURFACE AND BOTTOM SAMPLES TAKEN IN MARION LAKE [illegible]
AFTERMAT [illegible] PROPAGATIONAL STUDY YEAR 1

Parameter	June 29		November 8		November 12		February 11	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
Turbidity NTU	0.7	5.4	1.7	1.2	1.1	1.1	0.6	0.5
Secchi Depth m	1.[illegible]		2.0		2.0			
Conductivity mS/m	5.8	5.2	8.0	6.5	9.1	9.0	10.0	9.0
Suspended Solids 103°C mg/l	<1	<1	<1	3.6	2.0	1.6	<2	<2
550°C mg/l	<1	<1	<1	2	1.0	0.6	<2	<2
Dissolved Solids 103°C mg/l	54	60	58	48	67	67	60	50
550°C mg/l	32	16	32	42	40	33	30	30
Colour	-	-	None	None	-		None	None
pH	7.1	6.5	6.0	5.8	6.6	6.6	6.9	6.6
Dissolved Oxygen mg/l	13.6[a]	6.0[a]	8.6	0.0	11.5	10.5	12.6[b]	2.0[b]
Gran Alkalinity (HCO_3 or $CaCO_3$) mg/l	28	28	30	26	31	30	34	31
Hardness ($CaCO_3$) mg/l	31	31	42	36	39	39	46	42
Calcium mg/l	8	9	12	10	11	11	13	12
Magnesium mg/l	2.6	2.4	2.6	2.1	2.9	2.9	3.6	3.1
Sodium mg/l	1.8	1.7	1.7	1.1	1.7	1.7	1.9	1.2
Sulphate (SO_4) mg/l	7.3	4.6	8.6	5.6	8.2	8.3	10.1	8.6
Iron Suspended mg/l	<0.05	0.20	0.051	0.026	0.057	0.101	0.016	0.023
Dissolved mg/l	<0.05	0.83	<0.05	0.21	0.05	0.05	<0.05	0.12
Nickel mg/l	<5	<5	<5	<5	<5	<5	<5	<5
Aluminum mg/l	1.4	0.91	<0.12	0.46	<0.15	<0.15	<0.2	<0.2
Copper mg/l	6	5	1	1	2	4	1	1
Zinc mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese mg/l	<0.05	0.55	<0.02	0.10	0.02	0.02	<0.02	0.04
Mercury mg/l	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Organic Carbon mg/l	9.9	5.5	8.2	7.9	6.6	6.9	9	8
Total Inorganic Carbon mg/l	7.7	8.4	7.2	6.4	7.3	7.3	8	9
Chloride mg/l	<2	<2	1.7	1.4	1.5	2.0	2.0	1.4
Potassium mg/l	0.6	0.5	0.7	0.6	0.6	0.6	0.8	0.7
Total Phosphorus mg/l	21	<2	11	10	6	6	22	5
Soluble Phosphorus mg/l	11	22	9	<5	4	1	6	<5
Particulate Phosphorus mg/l	10	20	2		2	5	16	-
Total Kjeldahl Nitrogen mg/l	0.61	0.32	0.68	0.55	0.32	0.36	0.35	0.18
Soluble Nitrogen mg/l	0.61	0.30	0.65	0.55	0.29	0.29	0.31	0.30
Particulate Nitrogen mg/l	0.0	0.02	0.03	0.0	0.03	0.07	0.04	0.08
Nitrate (NO_3) mg/l	<0.01	1.0	<0.2	<0.6	0.05	0.06	0.20	0.22
Nitrite (NO_2) mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Total Silica (SiO_2) mg/l	2.7	5.9	2.9	6.8	3.4	3.5	3.1	3.8
Soluble Silica (SiO_2) mg/l	2.6	5.2	2.3	6.1	2.3	2.4	2.3	1.8
Ammonia (NH_3) mg/l	<0.01	<0.05	0.10	0.02	<0.01	<0.01	0.01	<0.01
Arsenic mg/l							0.001	<0.001
Selenium mg/l							<0.001	<0.001

a) June 22, 1981
b) February 3, 1982

83-338

[illegible]

LEVELS OF WATER QUALITY PARAMETERS IN SURFACE AND BOTTOM
SAMPLES TAKEN IN ANDERSON DAM (1[illegible] a)
ATIKOKAN CS PREOPERATIONAL STUDY YEAR 1 JUNE 1981 TO FEBRUARY 11, 1982

Parameter	June 29		September 8		November 12		February 11	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
Turbidity NTU	1.6	10.0	1.5	5.1	2.3	2.5	0.6	1.0
Secchi Depth - m	2.20		1.4		1.6		-	-
Conductivity - uM/c	9.2	9.6	9.4	9.2	11.0	11.0	12.0	11.0
Suspended Solids 105°C mg/L	<1	22	3.2	4.4	3.4	4.5	<2	<2
550°C mg/L	<1	3	<1	2.8	2.8	3.6	<2	<2
Dissolved Solids 105°C mg/L	70	66	76	90	75	75	80	80
550°C mg/L	56	62	56	66	65	56	50	60
Colour			None	None			None	None
pH	7.5	6.9	6.0	6.1	6.5	6.5	6.5	6.4
Dissolved Oxygen - mg/L	13.2[a]	6.6[a]	8.6	9.0	12.1	10.9	12.1[b]	6.1[b]
Gran Alkalinity (HCO_3 as $CaCO_3$) mg/L	33	34	34	33	36	36	38	41
Hardness ($CaCO_3$) mg/L	45	51	49	48	48	48	52	44
Calcium - mg/L	12	13	14	14	13	13	15	17
Magnesium mg/L	3.6	4.4	3.5	3.5	3.9	3.9	4.5	5.1
Sodium mg/L	2.4	2.8	1.9	2.0	2.1	2.1	2.4	2.8
Sulphate (SO_4) mg/L	12	14	11	11	12	12	16	18
Iron Suspended mg/L	<0.05	0.225	0.11	0.076	0.165	0.185	0.023	0.066
Dissolved mg/L	0.05	0.22	0.09	0.15	0.11	0.11	<0.05	<0.05
Nickel mg/L	<5	<5	<5	<5	<5	<5	<5	<5
Aluminum mg/L	<0.2	1.0	0.51	1.2	0.15	0.15	<0.2	<0.2
Copper mg/L	2	1	1	2	<1	<1	2	3
Zinc mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese mg/L	<0.05	0.59	0.12	0.17	0.03	0.03	<0.02	0.08
Mercury mg/L	<0.4	<0.4	1.0	<0.4	<0.2	<0.2	<0.2	<0.2
Total Organic Carbon mg/L	5.9	5.2	6.5	9.0	6.9	6.5	8	8
Total Inorganic Carbon mg/L	10.3	10.0	8.4	6.5	9.1	8.9	10	12
Chloride - mg/L	2.2	2.2	1.9	2.1	1.9	1.9	5.0	2.6
Potassium mg/L	0.8	1.0	<0.4	<0.8	0.7	0.7	0.9	1.0
Total Phosphorus mg/L	47	52	16	15	15	9	7	8
Soluble Phosphorus g/L	17	26	11	7	5	5	<5	<5
Particulate Phosphorus mg/L	30	26	0	8	10	4		
Total Kjeldahl Nitrogen mg/L	0.33	0.49	0.37	0.54	0.36	0.35	0.91	0.32
Soluble Nitrogen mg/L	0.38	0.34	0.55	0.51	0.29	0.31	0.78	0.28
Particulate Nitrogen mg/L	0.03	0.15	0.02	0.03	0.07	0.06	0.13	0.05
Nitrate (NO_3) mg/L	0.02	0.48	<0.2	<0.2	<0.01	<0.01	<0.02	<0.01
Nitrite (NO_2) mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Silica (SiO_2) mg/L	7.7	8.1	5.2	5.8	6.7	6.7	6.9	5.9
Soluble Silica (SiO_2) mg/L	3.9	3.9	2.7	5.6	2.6	3.0	3.1	6.2
Arsenic mg/L	<0.01	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium mg/L							<0.001	<0.001
							<0.001	<0.001

a) June 22, 1981
b) February 8, 1982

83-338

APPENDIX 5 (cont'd)

LEVELS OF WATER QUALITY PARAMETERS IN SURFACE AND BOTTOM SAMPLES TAKEN IN MARION LAKE SOUTH (12 m)

ATIKAMAN CS PREOPERATIONAL STUDY YEAR 1 - JUNE 1981 TO FEBRUARY 1982

Parameter	June 22		September 8		November 12		February 11	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
Turbidity - NTU	0.6	1.6	1.0	1.0	1.3	1.0	1.9	1.2
*Secchi Depth - m	1.6[a]		1.0		1.5		-	
Conductivity - uS/m	8.3	9.7	8.2	8.6	9.5	9.1	<3.2	9.6
Suspended Solids 105°C - mg/L	<1	<1	1.2	<1	2.4	2.2	<2	<2
550°C - mg/L	<1	<1	1.2	<1	1.2	1.2	<2	<2
Dissolved Solids 105°C - mg/L	66	76	72	64	59	60	60	50
550°C - mg/L	60	52	68	56	44	45	30	10
Colour			None	None			None	None
pH	7.2	6.5	6.1	5.9	6.6	6.6	6.5	6.5
*Dissolved Oxygen - mg/L	13.6[a]	3.0[b]	8.6	0.0	11.1	8.9	13.1	0.0[b]
Gran Alkalinity (HCO_3 as $CaCO_3$) - mg/L	30	35	30	32	36	33	36	35
Hardness ($CaCO_3$) - mg/L	37	44	43	46	42	42	47	45
Calcium - mg/L	10	12	12	13	12	12	13	13
Magnesium - mg/L	3.0	3.4	2.9	3.1	3.1	3.1	3.4	3.2
Sodium - mg/L	2.0	2.3	1.8	1.8	1.9	1.9	2.2	2.1
Sulphate (SO_4) - mg/L	10	11	9.2	11	8.3	8.1	10.3	11.3
Iron Suspended - mg/L	<0.005	<0.005	0.020	0.020	0.044	0.055	0.029	0.024
Dissolved - mg/L	<0.05	<0.24	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel - mg/L	<5	<5	<5	<5	<5	<5	<5	<5
Aluminum - mg/L	<0.2	0.96	<0.12	<0.12	<0.15	<0.15	<0.2	<0.2
Copper - mg/L	4	1	1	2	<1	<1	2	2
Zinc - mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese - mg/L	<0.05	2.55	<0.02	<0.02	0.06	0.04	<0.02	0.18
Mercury - mg/L	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Organic Carbon - mg/L	5.8	7.3	6.9	6.7	7.2	6.3	9	8
Total Inorganic Carbon - mg/L	12.0	6.2	8.0	9.4	8.3	8.8	10	10
Chloride - mg/L	1.9	2.4	1.8	1.9	1.7	1.7	2.0	1.9
Potassium - mg/L	0.7	0.8	0.7	0.7	0.6	0.6	0.8	0.8
Total Phosphorus - ug/L	16	39	19	6	17	16	9	13
Soluble Phosphorus - ug/L	11	22	9	6	11	6	8	6
Particulate Phosphorus - ug/L	5	17	10	0	6	8	1	7
Total Kjeldahl Nitrogen - mg/L	0.45	0.32	0.54	0.41	0.31	0.35	0.42	0.37
Soluble Nitrogen - mg/L	0.37	0.26	0.50	0.43	0.26	0.31	0.33	0.31
Particulate Nitrogen - mg/L	0.08	0.06	0.04	0.0	0.07	0.02	0.09	0.06
Nitrate - (NO_3) - mg/L	<0.01	0.77	<0.2	0.6	0.02	0.02	0.16	0.28
Nitrite - (NO_2) - mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Silica (SiO_2) - mg/L	1.8	4.1	2.8	5.0	3.1	3.5	2.9	3.5
Soluble Silica (SiO_2) - mg/L	1.6	3.6	2.0	3.9	1.7	1.7	2.2	2.7
Ammonia (NH_3) - mg/L	<0.01	<0.01	0.01	0.02	<0.01	<0.01	0.01	0.01
Arsenic - mg/L							<0.001	0.001
Selenium - mg/L							<0.0002	<0.0002

a) June 22, 1981
b) February 4, 1982

APPENDIX 3 (cont'd)

LEVELS OF WATER QUALITY PARAMETERS IN SURFACE AND BOTTOM SAMPLES TAKEN IN LOWER SEINE LAKE (18 m)

ATIKOKAN GS PREOPERATIONAL STUDY YEAR 1 - JUNE 1981 TO FEBRUARY 1982

Parameter	June 29		September 8		November 12		February 11	
	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom
Turbidity - NTU	0.8	1.4	1.2	1.8	1.1	2.1	0.5	0.9
Secchi Depth - m	4		4.2		2.9		-	
Conductivity - mho/m	7.8	8.1	8.0	8.3	9.1	9.2	9.0	9.1
Suspended Solids 105°C - mg/L	<1	<1	<1	1.6	0.4	2.0	<2	<2
550°C - mg/L	<1	<1	<1	1.6	<0.2	1.2	<2	<2
Dissolved Solids 105°C - mg/L	58	68	74	72	62	67	60	60
550°C - mg/L	46	60	70	70	41	41	50	60
Colour	-	-	None	None			None	None
pH	7.4	6.6	5.8	5.7	6.6	6.4	6.5	6.6[b]
Dissolved Oxygen - mg/L	11.5[a]	5.6[a]	8.4	0.0	11.4	8.5	12.4	0.0
Gran Alkalinity (HCO_3^-) or ($CaCO_3$) mg/L	29	27	28	28	31	31	31	31
Hardness ($CaCO_3$) - mg/L	30	30	42	45	39	39	42	42
Calcium - mg/L	11	11	13	13	11	11	12	12
Magnesium - mg/L	2.9	3.0	2.7	2.8	2.8	2.8	3.0	3.0
Sodium - mg/L	2.0	2.3	1.7	1.8	1.6	1.7	1.6	1.7
Sulphate (SO_4^{2-}) - mg/L	8.0	9.8	7.6	8.2	1.6	1.6	8.5	8.3
Iron Suspended - mg/L	<0.05	0.053	0.015	0.005	0.050	0.086	0.020	0.044
Dissolved - mg/L	<0.05	<0.05	0.14	<0.05	<0.05	<0.05	<0.05	0.02
Nickel - mg/L	<5	<5	<5	<5	<5	<5	<5	<5
Aluminum - mg/L	<0.2	<0.2	<0.12	<0.12	0.18	0.15	<0.2	<0.2
Copper - mg/L	1	2	1	1	<5	2	2	2
Zinc - mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese - mg/L	<0.05	<0.16	<0.02	0.55	<0.02	0.07	<0.02	<0.02
Mercury - ng/L	<0.4	<0.4	<0.2	1.0	<0.2	<0.2	<0.2	<0.2
Total Organic Carbon - mg/L	6.9	6.8	7.3	6.4	5.7	5.7	7	8
Total Inorganic Carbon - mg/L	10.1	15.6	8.0	9.1	8.4	8.0	8	8
Chloride - mg/L	<2	<2	1.7	1.7	1.6	1.6	1.8	1.8
Potassium - mg/L	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.8
Total Phosphorus - ng/L	20	28	6	11	6	10	5	15
Soluble Phosphorus - ng/L	10	22	<5	9	1	4	4	6
Particulate Phosphorus - ng/L	2	6		2	5	6	11	9
Total Kjeldahl Nitrogen - mg/L	0.42	0.18	0.59	0.48	0.36	0.38	8	0.10
Soluble Nitrogen - mg/L	0.19	0.16	0.59	0.48	0.28	0.30	8	0.13
Particulate Nitrogen - mg/L	0.03	0.02	<0.01	<0.01	0.08	0.08	8	
Nitrate - (NO_3^-) - mg/L	<0.01	0.41	<0.2	<0.2	0.12	0.12	0.20	0.25
Nitrite - (NO_2^-) - mg/L	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Total Silica (SiO_2) - mg/L	1.0	3.4	1.9	5.9	3.5	3.1	3.0	3.9
Soluble Silica (SiO_2) - mg/L	0.9	3.3	1.8	5.0	2.6	1.9	3.5	3.5
Ammonia (NH_3) - mg/L	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	0.03	0.03
Arsenic - mg/L							0.001	0.001
Selenium - mg/L							<0.001	<0.001

a June 22, 1981
b February 5, 1982

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LEVELS OF WATER QUALITY PARAMETERS IN SURFACE
AND BOTTOM SAMPLES TAKEN IN SLOCAN LAKE
ATHABASCA GS PREOPERATIONAL STUDY YEAR 1

Parameters	September 8		November 12		February 11	
	Surface	Bottom	Surface	Bottom	Surface	Bottom
Turbidity - NTU	1.2	1.8	1.0	1.7	0.6	0.8
Secchi Depth - m	-	-				
Conductivity - mho/m	5.0	6.8	13.1	13.1	5.7	5.6
Suspended Solids 105°C - mg/L	<1	2	a	1.0	<2	<2
550°C - mg/L	<1	2	a	1.2	<2	<2
Dissolved Solids 105°C - mg/L	52	54	87	88	10	10
550°C - mg/L	52	54	58	63	10	10
Colour	None	None			None	None
pH	5.6	5.5	6.5	6.9	6.5	6.7
Dissolved Oxygen - mg/L	8.4	8.0	11.8	9.9	10.6	1.4
Alkalinity HCO_3 as $Ca(CO_3)$ mg/L	21	18	55	56	24	21
Hardness ($CaCO_3$) mg/L	28	27	58	58	27	27
Calcium - mg/L	10	9	18	18	9	9
Magnesium - mg/L	1.0	1.0	3.6	3.6	1.2	1.2
Sodium - mg/L	0.6	0.6	3.0	3.1	0.6	0.6
Sulphate - mg/L	2.3	2.3	4.4	3.8	2.1	2.1
Iron Suspended - mg/L	0.010	0.028	0.074	0.055	0.012	0.052
Dissolved - mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	0.08
Nickel - µg/L	<5	<5	<5	<5	<5	5
Aluminium - mg/L	<0.12	<0.21	<0.15	<0.15	<0.2	<0.2
Copper - µg/L	1	2	<1	1	2	5
Zinc - mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese - mg/L	<0.02	0.30	0.03	0.03	<0.02	<0.02
Mercury - µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Total Organic Carbon - mg/L	9.0	8.0	a	14	7	6
Total Inorganic Carbon mg/L	4.5	3.2	a	5.5	6	7
Chloride - mg/L	0.3	0.3	3.0	3.8	0.5	0.5
Potassium - mg/L	0.4	0.4	0.8	0.8	0.5	0.5
Total Phosphorus - µg/L	<5	24	10	9	7	9
Soluble Phosphorus - µg/L	<5	16	1	1	6	7
Particulate Phosphorus - µg/L	<5	8	9	6	1	7
Total Kjeldahl Nitrogen mg/L	0.55	0.71	0.61	0.61	0.32	0.30
Soluble Nitrogen - mg/L	0.55	0.65	a	0.37	0.30	0.31
Particulate Nitrogen mg/L	0.0	0.06	a	0.06	0.02	-
Nitrate (NO_3) - mg/L	<0.2	<0.2	0.05	0.05	0.38	0.68
Nitrite (NO_2) - mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Silica - mg/L	4.9	2.1	3.3	3.1	2.2	2.0
Soluble Silica - mg/L	1.0	2.0	2.7	2.5	1.2	1.7
Ammonia (NH_3) - mg/L	0.01	0.03	<0.01	<0.01	0.02	0.04
Arsenic - mg/L					<0.001	<0.001
Selenium - mg/L					<0.001	<0.001

a - Leached Bottle

APPENDIX 4

DRY WEIGHTS AND ASH FREE DRY WEIGHTS (g/m^2) OF ATTACHED ALGAE AND DETRITUS - ATIKOKAN - 1981

Sampling Locations	Dry Weight			Ash-Free Dry Weight		
	May	August	October	May	August	October
Marmion Lake Central 1 m depth	5.08 5.56 3.16	14.08 23.52 15.08	8.96 35.48 7.56	0.16 0.16 0.32	5.36 5.88 4.68	3.24 28.68 3.64
Marmion Lake Central 3 m depth	17.23 3.48 9.88	2.32 2.60 3.24	13.48 237.52 2.56	3.64 0.76 3.80	1.12 1.04 0.88	4.56 232.28 0.88
Abie Lake 1 m depth	6.00 5.20 4.08	13.04 8.60 18.76	11.12 9.72 9.60	2.00 1.76 0.44	6.20 5.24 12.24	7.64 7.12 6.56
Abie Lake 3 m depth	18.76 17.92 23.84	67.92 69.32 46.04	Sample Lost 39.56 29.36	9.96 8.32 13.48	28.68 22.36 21.48	Sample Lost 11.08 7.40
Anderson Dam 1 m depth	2.36 2.96 3.92	19.16 27.60 30.36	11.40 20.12 10.12	0.04 0.12 0.80	4.00 5.88 6.36	2.08 1.80 2.32
Anderson Dam 3 m depth	20.80 20.64 7.28	8.96 8.76 7.56	No Samples Collected	1.48 2.32 0.44	2.12 2.08 1.60	No Samples Collected
Snow Lake 1 m depth	5.40 15.52 18.76	10.60 12.08 11.32	7.84 11.52 15.88	4.16 8.72 12.56	5.68 7.16 6.52	3.16 4.28 4.12
Snow Lake 3 m depth	32.48 23.20 29.24	20.00 28.36 37.48	13.56 25.28 40.28	20.28 12.24 17.88	6.16 11.00 14.32	6.00 10.76 18.96
Icy Lake 1 m depth	23.68 31.40 48.76	30.12 37.08 27.92	9.08 1.52 3.80	11.92 15.28 24.60	17.12 19.68 15.32	4.00 0.72 1.40
Icy Lake 3 m depth	46.56 56.44 31.48	14.64 19.28 9.96	15.64 15.64 3.52	12.20 11.84 14.64	8.64 11.12 5.60	13.80 9.04 1.04
Moose Lake 1 m depth	17.16 14.24 21.08	13.96 14.72 17.36	17.28 9.68 15.84	2.60 2.00 3.28	5.08 4.20 5.32	3.64 1.72 3.92
Moose Lake 3 m depth	Samples Lost	4.96 3.84 3.16	4.40 6.20 53.64	Samples Lost	1.40 1.40 0.52	0.72 1.52 12.44
Slush Lake 1 m depth	No Samples Collected	11.24 11.08 13.12	6.40 3.68 7.24	No Samples Collected	7.92 6.60 8.52	1.92 2.28 3.52
Slush Lake 3 m depth	No Samples Collected	13.60 11.08 16.48	6.84 3.68 28.40	No Samples Collected	7.60 5.28 8.20	1.60 2.16 3.36
Marmion Lake South 1 m depth	7.24 8.76 6.64	5.04 3.28 10.04	3.44 3.88 3.08	2.28 2.64 1.56	1.12 0.84 1.20	0.92 1.36 0.92
Marmion Lake South 3 m depth	4.44 7.72 13.68	15.44 9.28 15.00	6.28 5.68 5.08	0.04 0.20 1.08	12.52 5.08 10.68	1.92 1.88 0.92
Lower Seine 1 m depth	1.28 5.36 4.04	8.44 7.40 5.52	86.60 3.64 2.52	0.32 0.28 0.16	2.36 1.24 1.52	5.08 0.88 0.76
Lower Seine 3 m depth	12.76 6.88 3.92	5.80 8.32 6.76	1.60 3.28 2.16	0.80 0.44 0.40	1.84 2.36 1.36	0.32 1.60 1.12

APPENDIX 5

MACROPHYTE BIOMASS (g/m^2 DRY WEIGHT)

Month	May 14 - 19		August 6 - 12		October 5 - 8	
Location / Depth	1 m	3 m	1 m	3 m	1 m	3 m
Anderson Dam	5.2	4.8	14.0	2.8	2.0	32.0
	7.6	12.4	9.2	54.0	0.8	32.8
	1.6	11.6	14.8	64.8	3.2	37.6
Marmion Lake North	17.2	0	31.2	4.8	25.6	24.0
	10.0	0	12.8	6.4	0.8	54.0
	10.8	0	7.6	45.6	21.6	26.8
Marmion Lake Central	7.6	5.6	15.6	7.2	8.0	0
	15.6	2.4	3.6	3.6	2.0	0
	2.8	2.8	8.0	5.2	NS	0
Marmion Lake South	5.6	11.2	NS	NS	42.4	6.0
	7.6	19.2			18.0	31.6
	4.8	8.4			44.8	26.0
Lower Seine Bay	*0.8	NS	NS	NS	46.0	75.6
	0.004				42.8	87.2
	0.8				21.2	69.6
Abie Lake	13.6	0	NS	NS	6.8	2.0
	0.4	0			4.0	11.6
	0.2	0			2.0	10.4
Icy Lake	0.4	0	5.6	0	5.6	NS
	2.4	0	5.6	0	5.6	
	5.2	0	4.4	0	2.0	
Slush Lake	NS	NS	18.4	3.6	1.6	2.0
			1.6	9.2	20.4	3.2
			22.8	5.2	8.0	3.2
Snow Lake	7.2	0	26.0	14.0	12.0	0
	8.0	0	4.4	0.4	1.6	0
	4.8	0	6.4	0.8	12.8	0

APPENDIX 5 (cont'd)

WILDLIFE UTILIZING THE AQUATIC PLANTS IN THE LAKES IN THE PROPOSED ATIKOKAN GS COOLING CIRCUIT AND CONTROL AREAS

Brasenia schreberi	duck food
Ceratophyllum demersum	duck food, but not choice food
Chara sp	among top ranking duck foods
Eleocharis spp	moderately valuable to ducks, rabbits and muskrats
Elodea canadensis	eaten in limited quantities by ducks, beaver, muskrat
Equisetum sp	roots and stems eaten by geese and swans, entire plants by moose
Eriocaulon septangulare	leaves eaten by ducks
Glyceria grandis	duck and muskrat food, heavily grazed by deer
Juncus effusus	wildfowl, sparingly eaten by muskrat and moose
Myriophyllum spp	sparingly eaten by ducks, muskrat and moose
Najas flexilis	choice duck food
Nuphar sp	deer eat leaves, stems and flowers, beaver and porcupine eat the roots
Nymphaea odorata	fair food value for moose, duck, beaver, muskrat and porcupine
Polygonum natans	duck food, sparingly eaten by muskrat
Potamogeton spp	good duck food, often heavily eaten by muskrats, beaver, deer, moose
Sagittaria sp	food for muskrat, porcupine, beaver; tubers are eaten by ducks
Scirpus sp	food for waterfowl and muskrat

Sparganium fluctuans	seeds eaten by waterfowl
Typha spp	rootstocks eaten by geese, muskrat and beaver; provide cover for ducks
Utricularia vulgaris	sparingly eaten by mustkrat
Vallisneria americana	excellent for ducks and muskrat

APPENDIX 6

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**3)

	JUNE 4 1981 ABIE LAKE	JUNE 4 1981 MARMION LAKE -ANDERSON DAM	JUNE 4 1981 ICY LAKE	JUNE 4 1981 MARMION LAKE -LOWER SEINE BAY	JUNE 4 1981 MARMION LAKE -CENTRAL	JUNE 4 1981 MARMION LAKE -NORTH	JUNE 4 1981 MARMION LAKE -SOUTH
ANABAENA SP	.0	.0	.0	.0	1.8	.0	.0
ANABAENA FLOS-AQUAE	6.8	.0	.0	9.1	.0	.0	39.0
ANACYSTIS SP	.0	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	.0	.0	.0	.0	2.4	.0	.0
APHANOCAPSA SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP	.0	12.6	57.6	10.8	.0	5.4	.0
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	.0	.0	.0	.0	.0	.0
OSCILLATORIA SPP	.0	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP A	.0	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0	.0	.0
ANABAENA PLANCTONICA	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.2	.2	.1
VAR MIRABILIS							
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	.0
COSMARIUM SP	.0	.0	.0	.0	.0	.0	.0
CRUCIGENIA SP	.0	.0	.0	.0	.0	.1	.0
GLOEOTRICHIA GELATINOSA	3.0	.0	1.0	.4	.4	1.0	1.2
KIRCHNERIELLA SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
NUCYSTIS SP	.0	.0	.0	.0	.0	.0	.0
SCENEDESMUS BIJUGA	.0	.0	.0	.0	.0	.0	.0
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA GRACILLIMA	10.2	15.4	23.0	19.2	38.4	19.2	28.2
TABELLA SP	.0	.0	2.3	.0	.0	.0	.0
DIATOMA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA SP	.0	.0	.0	.0	.0	.0	1.5
FRAGILARIA CROTONENSIS	.6	6.1	8.0	2.6	.0	.0	9.3
NUCICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	.0
PINNEDRA SP	.0	.0	.0	.0	.0	.0	.0
PINNEDRA ULNA	.0	.0	.0	.0	50.0	.0	100.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	100.0	35.0	65.0	220.0	125.0	20.0	140.0
CYMBALES	.0	.0	.0	.0	.0	.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.0	.0	.0
GLOSIRA SP	.0	.0	.0	.0	.0	.0	.0
GLOSIRA GRANULATA	44.5	.0	120.8	44.5	.0	.0	44.5
RHIZOSOLENIA SP	.0	.0	12.0	6.0	18.0	6.0	12.0
STEPHANODISCUS SP	.0	.2	.0	.0	.0	.0	.0
DINOBRYON SP	2.7	1.9	8.4	13.7	23.9	.0	23.6
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	.0	.0	.0	.0	.0	.0	.5
CHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	.0	.0	.0	.3	.0	.0	.0
DINOBRYON SERTULARIA	.0	.0	.0	.0	8.4	12.3	4.2
DINOBRYON BAVARICUM	3.8	.0	3.0	9.9	9.1	30.4	11.4
MALLOMONAS	.0	.0	.9	.0	.0	.0	.3
PSEUDOCORONATA							
DINOBRYON CRENULATUM	.0	.0	.5	.0	.5	.5	.5
DITRICHIA CHODATTI	.0	.0	.2	.0	.0	.2	.0
CRYPTOPHYTA TYPE 1	1.3	.4	.0	.4	.6	.4	.4
CRYPTOMONAS SP	140.8	183.0	119.7	126.7	232.3	84.5	183.0
CHROOMONAS MINUTA	68.7	89.3	34.8	35.6	89.3	35.2	45.8
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	.0	.0	.0
PERIDINIUM SP	.0	.0	.0	.0	.0	.0	.0
TOTALS FOR ALL SPECIES	374.5	343.9	456.0	498.9	599.8	215.7	664.7

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**3)

	JUNE 4 1981 SNOW LAKE	JUNE 5 1981 MOOSE LAKE	JUNE 22 1981 MARMION LAKE -ANDERSON DAM	JUNE 22 1981 FOTHERINGHAM LAKE	JUNE 22 1981 ICY LAKE	JUNE 22 1981 MARMION LAKE -LOWER SEINE BAY	JUNE 22 1981 MARMION LAKE -NORTH
ANABAENA SP	.3	.0	.0	.0	.0	.0	.0
ANABAENA FLOS-AQUAE	.3	66.6	6.5	23.4	10.9	15.1	31.5
ANACYSTIS SP	.0	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	.0	.0	1.3	.0	.0	.0	.0
APHANOCAPSA SP	.3	.3	.0	.0	.3	.0	.3
CHROOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS DISPERSUS	.3	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	2.2	.0	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	.0	.0	.0	.0	.0	.0
OSCILLATORIA SPP	.0	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP A	.0	.0	3.6	.0	.0	5.4	9.4
COELOSPHAERIUM SP B	.3	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0	.0	.0
ANABAENA PLANCTONICA	.3	.0	.0	.0	.0	.0	.3
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.0	.0	.0	.0	.0	.1
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	.0
COSMARIUM SP	.0	13.2	.0	.0	.0	.0	.0
CRUCIGENIA SP	.0	.0	.0	2.8	.0	.0	1.1
ELAKATOTHRIX GELATINOSA	.0	.6	.0	.0	.0	.0	1.6
KIRCHNERIELLA SP	.3	.0	.0	.0	.0	.3	.0
MICRACTINIUM SP	.3	.0	.0	.0	.0	.0	.3
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
OOCYSTIS SP	.3	2.0	4.0	.0	.0	4.0	13.3
SCENEDESMUS BIJUGA	.0	.5	.0	.0	.2	.0	.0
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.3	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.3
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA GRACILLIMA	10.2	6.4	32.0	.0	19.4	21.0	119.0
CYMBELLA SP	2.0	.0	.0	.0	.0	.0	.3
DIATOMA SP	.0	.3	.0	.0	.0	.0	.3
DIATOMA ELONGATUM	.0	.0	.0	.0	.0	.0	.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NAVICULA CROTONENSIS	3.8	1.0	.0	.0	10.6	.0	[illegible]
RHOICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	[illegible]
SYNEDRA SP	.0	.0	.0	.0	.0	.0	[illegible]
SYNEDRA ULNA	.0	.0	.0	.0	.0	.3	[illegible]
TABELLARIA SP	.3	.3	.3	.0	.3	.0	[illegible]
TABELLARIA FENESTRATA	10.0	.0	150.0	10.0	95.0	745.0	135.0
CENTRALES	29.0	.0	.0	2.0	.0	2.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.0	.0	[illegible]
MELOSIRA SP	.0	.0	.0	.0	.0	.0	[illegible]
MELOSIRA GRANULATA	57.2	.0	.0	.0	.0	23.4	3[illegible].0
RHIZOSOLENIA SP	60.6	12.0	12.0	.0	.0	66.0	6.3
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	47.1	13.3	8.7	.0	6.1	7.2	16.3
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	.0	.0	.0	.0	.0	.0	.0
OCHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SERTULARIA	19.0	.0	39.5	.0	.0	.0	55.5
DINOBRYON BAVARICUM	26.4	.0	.3	6.1	.0	.0	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	1.5	.0	.0	.0	.0	.0	.0
NITRICHIA CHODATTI	.0	.0	.1	.1	.1	.2	.0
CRYPTOPHYTA TYPE 1	.4	7.9	1.8	5.3	1.8	3.5	.8
CRYPTOMONAS SP	84.5	788.3	218.2	323.8	274.6	78.4	253.4
RHODOMONAS MINUTA	17.6	63.4	47.1	48.0	87.6	73.0	147.0
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	78.0	78.0	.0	148.0	.0
PERIDINIUM SP	.0	99.6	.0	.0	.0	.0	.0
TOTALS FOR ALL SPECIES	363.1	1074.9	594.8	484.3	582.0	1179.9	821.5

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**3)

	JUNE 22 1981 MARMION LAKE -SOUTH	JUNE 23 1981 ABIE LAKE	JUNE 23 1981 MARMION LAKE -CENTRAL	JUNE 23 1981 MOOSE LAKE	JUNE 23 1981 SNOW LAKE	JULY 28 1981 MOOSE LAKE	JULY 28 1981 SNOW LAKE
ANABAENA SP	52.5	.0	.0	3.4	.0	.0	.0
ANABAENA FLOS-AQUAE	.0	2.9	68.4	.0	.0	85.8	.0
ANACYSTIS SP	.0	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	1.2	.0	.0	.0	.7	.0	.0
APHANOCAPSA SP	.3	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	12.7	.6
MICROCYSTIS SP	.0	.0	.0	.0	.0	.0	.0
OSCILLATORIA SPP	.0	.0	.0	.0	2.7	28.7	.0
COELOSPHAERIUM SP A	2.7	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0	.0	2.6
ANABAENA PLANCTONICA	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.0	.0	.1
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.1	.0	.0	.0	.0	.0	.0
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	496.8
COELASTRUM SP	.0	.0	.0	13.2	.0	.0	13.2
COSMARIUM SP	.0	.0	.0	.6	.6	1.1	.0
CRUCIGENIA SP	1.1	.0	2.0	.0	1.2	1.8	.6
ELAKATOTHRIX GELATINOSA	.0	.0	.0	.0	.0	.0	.0
KIRCHNERIELLA SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	4.0	4.0	14.8	.0	.0
OOCYSTIS SP	5.0	.0	.0	.5	.2	.5	.0
SCENEDESMUS BIJUGA	.0	.0	.0	.0	.0	.0	.0
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0	6.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	12.8	16.6	.0
ASTERIONELLA GRACILLIMA	61.4	14.1	55.0	.0	.0	.0	.0
CYMBELLA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA SP	5.7	.0	.0	.0	8.3	7.4	3.2
FRAGILARIA CROTONENSIS	5.1	.0	.0	.0	.0	.0	.0
RHOICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	.0
SYNEDRA SP	.0	.0	.0	.0	.0	.0	.0
SYNEDRA ULNA	58.0	.0	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	375.0	.0	139.0	.0	.0	.0	.0
PENNALES	.0	2.0	2.0	.0	.0	.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA GRANULATA	.0	78.0	63.6	.0	.0	.0	.0
RHIZOSOLENIA SP	72.0	4.0	24.0	12.0	.0	.0	.0
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	11.0	213.2	11.8	.0	6.5	2.7	12.9
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	.0	.0	.0	.0	.0	.0	.0
OCHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SERTULARIA	.0	35.0	.0	.0	23.2	9.5	.0
DINOBRYON BAVARICUM	3.8	.0	.0	.0	.0	.0	.0
MALLOMONAS	.0	.0	.0	.0	.0	.0	.0
PSEUDOCHROMATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CREMULATUM	.0	.0	.0	.0	.2	.0	.5
BITRICHIA CHODATTI	.2	.1	.3	.0	.0	.9	2.4
CRYPTOPHYTA TYPE 1	4.8	6.6	.0	.4	58.3	35.2	14.1
CRYPTOMONAS SP	78.4	154.9	185.4	389.8	44.4	14.1	11.4
RHODOMONAS MINUTA	29.9	41.8	18.0	118.4	.0	.0	.0
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	70.8	.0	.0	.0	.0
PERIDINIUM SP	.0	.0	.0	66.4	.0	.0	.0
TOTALS FOR ALL SPECIES	792.0	546.4	599.8	528.6	171.1	222.8	559.7

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**3)

	JULY 29 1981 ICY LAKE	JULY 29 1981 SLUSH LAKE	JULY 30 1981 ABIE LAKE	JULY 30 1981 MARMION LAKE -ANDERSON DAM	JULY 30 1981 MARMION LAKE -LOWER SEINE BAY	JULY 30 1981 MARMION LAKE -NORTH	JULY 30 1981 MARMION LAKE -SOUTH
ANABAENA SP	.0	.0	.0	.0	.0	.0	.0
ANABAENA FLOS-AQUAE	4.9	.0	.0	.0	14.6	3.9	25.7
ANACYSTIS SP	.0	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	.0	1.1	.0	3.5	4.1	2.0	.0
APHANOCAPSA SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP	.0	.0	.0	.0	.0	.0	7.5
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	2.9	.0	.0	.0	.0	1.3
OSCILLATORIA SPP	.0	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP A	11.9	4.3	7.1	4.9	4.5	2.7	4.3
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0	.0	.0
ANABAENA PLANCTONICA	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.1	.0	.0	.0	.0	.1
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	.0
COSMARIUM SP	.0	26.4	.0	.0	39.6	.0	.0
CRUCIGENIA SP	.0	.0	.0	1.7	1.3	.0	.6
CLAKATOTHRIX GELATINOSA	.0	.0	.4	.0	.0	.0	.0
KIRCHNERIELLA SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
OOCYSTIS SP	.0	12.0	.0	1.0	.0	2.0	1.0
SCENEDESMUS BIJUGA	.0	.2	.3	.0	.0	.0	.0
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	4.7	.9	.0	.9	.0	1.9
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	24.0	45.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA GRACILLIMA	21.0	15.4	.0	.0	73.0	.0	51.2
CYMBELLA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA SP	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA CROTONENSIS	.0	1.9	2.6	.0	.0	.0	.0
MEIDOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	.0
SYNEDRA SP	.0	.0	.0	.0	.0	.0	.0
SYNEDRA ULNA	.0	.0	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	5.0	28.0	.0	5.0	.0	28.0	40.0
PENNALES	2.0	.0	.0	.0	.0	.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA GRANULATA	.0	.0	.0	.0	.0	.0	25.4
RHIZOSOLENIA SP	12.0	.0	.0	30.0	12.0	12.0	.0
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	12.5	4.9	13.7	36.1	17.9	18.2	18.6
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	.0	.9	.0	.0	.0	.0	.0
UCHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SERTULARIA	.0	.0	7.6	3.0	34.2	12.9	.0
DINOBRYON BAVARICUM	.0	.0	.0	.0	11.4	5.3	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0	.5	.0
BITRICHIA CHODATTI	.0	.0	.6	.0	.4	.0	.1
CRYPTOPHYTA TYPE 1	.0	1.0	11.9	.0	7.3	.0	1.3
CRYPTOMONAS SP	35.2	42.2	133.0	267.5	91.5	260.5	161.9
RHODOMONAS MINUTA	33.9	14.1	86.7	95.5	21.6	84.5	63.0
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	140.0	.0	140.0
PERIDINIUM SP	.0	.0	.0	.0	.0	.0	.0
TOTALS FOR ALL SPECIES	139.2	152.0	265.5	449.7	475.1	449.4	581.5

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**3)

	AUG. 27 1981 ICY LAKE	AUG. 27 1981 MOOSE LAKE	AUG. 27 1981 SNOW LAKE	AUG. 27 1981 SLUSH LAKE	AUG. 28 1981 ABIE LAKE	AUG. 28 1981 MARMION LAKE -ANDERSON DAM	AUG. 28 1981 MARMION LAKE -LOWER SEINE BAY
ANABAENA SP	.0	.0	.0	1.0	8.8	.0	29.5
ANABAENA FLOS-AQUAE	8.5	14.0	.0	.0	.0	8.3	.0
ANACYSTIS SP	.0	.0	.0	.2	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	4.3	.9	1.2	.0	.0	11.1	14.5
APHANOCAPSA SP	.0	147.6	.0	.0	.0	.0	.0
CHROOCOCCUS SP	12.6	.0	.0	.0	.0	.0	.0
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	1.6	1.0	.0	1.0
MICROCYSTIS SP	3.8	.0	.0	.0	.0	.0	.0
OSCILLATORIA SPP	.0	.0	.0	1.4	2.5	1.8	6.5
COELOSPHAERIUM SP A	7.2	52.4	9.6	.0	1.3	.0	.0
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0	77.2	32.5
ANABAENA PLANCTONICA	9.6	.0	.0	.0	.0	1.5	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.0	.0	.0	.0	.0	.0
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	13.2
COSMARIUM SP	.0	.0	.0	26.4	.0	.0	.0
CRUCIGENIA SP	.0	.0	.6	.6	.0	.0	2.0
ELAKATOTHRIX GELATINOSA	.4	.4	.4	.4	.0	.0	.0
KIRCHNERIELLA SP	.0	.1	.1	.0	.0	.0	.0
MICRACTINIUM SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
OOCYSTIS SP	.0	2.0	4.0	3.0	.0	.0	6.0
SCENEDESMUS BIJUGA	.0	.3	.0	.0	.3	.2	.0
SCENEDESMUS QUADRICAUDA	.3	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.4	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.9	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	16.6
STAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.5	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA GRACILLIMA	.0	.0	.0	19.2	33.3	34.6	49.1
CYMBELLA SP	.0	.0	.0	.0	2.8	.0	.0
DIATOMA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	.0	2.4	.0	.0
FRAGILARIA SP	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA CROTONENSIS	.0	.0	.0	.0	.0	.0	1.0
RHOICOSPHENIA CURVATA	.0	.0	.0	.0	20.8	.0	.0
SYNEDRA SP	.0	.0	.0	.0	2.0	.0	.0
SYNEDRA ULNA	.0	.0	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	.0	.0	.0	.0	.0	.0	.0
PENNALES	.0	.0	.0	.0	.0	.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA GRANULATA	19.1	.0	.0	.0	.0	.0	1.2
RHIZOSOLENIA SP	.0	.0	6.0	.0	.0	.0	.0
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	5.3	36.1	3.0	1.5	6.8	17.5	12.9
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	8.2	.0	24.5	.0	4.1	.0	.0
UCHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SERTULARIA	.0	.0	.0	.0	.0	85.5	12.5
DINOBRYON BAVARICUM	.0	45.6	.0	9.9	.0	14.4	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	4.1	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0	.0	.0
BITRICHIA CHODATTI	.0	.0	.0	.0	.0	.0	.0
CRYPTOPHYTA TYPE 1	.0	.1	.2	.0	8.4	1.3	2.2
CRYPTOMONAS SP	2.6	9.2	9.2	.9	183.0	198.1	91.5
RHODOMONAS MINUTA	148.8	91.5	148.8	35.2	97.7	32.1	31.7
CRYPTOPHYTA TYPE 2	53.2	62.0	18.0	18.9	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	.0	.0	.0
PERIDINIUM SP	.0	.0	.0	.0	.0	.0	.0
	66.4	.0	.0	.0	33.2	.0	33.2
TOTALS FOR ALL SPECIES	342.2	462.3	221.7	129.3	489.6	475.6	368.2

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**3)

	AUG. 28 1981 MARMION LAKE -CENTRAL	AUG. 28 1981 MARMION LAKE -NORTH	AUG. 28 1981 MARMION LAKE -SOUTH	SEPT 22 1981 ICY LAKE	SEPT 22 1981 MOOSE LAKE	SEPT 22 1981 SNOW LAKE	SEPT 22 1981 SLUSH LAKE
ANABAENA SP	.0	.0	.0	21.1	14.6	.0	1.6
ANABAENA FLOS-AQUAE	57.2	39.5	33.5	.0	.0	1.6	.0
ANACYSTIS SP	.0	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	22.1	2.0	18.8	2.1	3.4	.0	.0
APHANOCAPSA SP	.0	.0	10.4	.0	4.2	.0	.0
CHROOCOCCUS SP	14.4	64.8	40.5	.0	14.4	.0	5.4
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.2	.8	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	.0	3.2	.0	14.2	.0	10.9
OSCILLATORIA SPP	.0	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP A	4.5	.0	10.1	.0	.0	18.0	20.7
COELOSPHAERIUM SP B	1.8	1.3	.0	.0	.0	1.4	2.7
CHROOCOCCUS SP B	7.2	25.2	22.5	.0	.0	.0	18.0
ANABAENA PLANCTONICA	57.7	20.8	89.0	.0	.0	8.6	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.3	.0	.0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.0	.0	.0	.0	.0	.1
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	.0
COSMARIUM SP	.0	.0	.0	.0	.0	.0	13.2
CRUCIGENIA SP	.0	.0	.7	.0	.0	.0	.0
ELAKATOTHRIX GELATINOSA	.0	.0	.0	.4	.4	.4	.0
KIRCHNERIELLA SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM SP	.5	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
OOCYSTIS SP	.0	2.0	2.5	.0	.0	4.5	2.0
SCENEDESMUS BIJUGA	.0	.0	.2	.6	.0	.0	.5
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0	1.6	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED 3	4.3	.0	13.5	6.1	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	12.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	15.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA GRACILLIMA	5.1	34.6	17.9	78.1	10.2	.0	.0
CYMBELLA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA SP	.0	.0	.0	3.8	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	4.8	2.4	.0	2.4
FRAGILARIA SP	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA CROTONENSIS	.0	.0	1.3	52.2	.0	.0	1.0
ANOICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	.0
SYNEDRA SP	.0	.0	.0	.0	.0	.0	.0
SYNEDRA ULNA	.0	.0	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	.0	.0	.0	.0	.0	10.0	.0
TENNALES	.0	.0	.0	.0	.0	4.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA GRANULATA	.0	31.8	.0	108.1	.0	216.2	.0
RHIZOSOLENIA SP	.0	.0	9.0	30.0	.0	12.0	.0
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	11.8	15.2	4.4	8.7	11.0	4.6	4.5
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	12.5
MALLOMONAS SP	12.2	8.2	16.3	12.2	4.1	.0	16.3
OCHROMONAS SP	.0	.0	.0	.0	266.8	.0	.0
CHRYSOPHYTA TYPE 1	3.5	.0	13.7	.0	.0	.0	.0
DINOBRYON SERTULARIA	7.6	.0	11.0	.0	65.0	.0	.0
DINOBRYON BAVARICUM	4.6	17.5	.0	.0	.0	.0	6.1
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0	.0	.0
DITRICHIA CNODATTI	.0	.0	.1	.0	.0	.0	.0
CRYPTOPHYTA TYPE 1	.9	.4	6.2	.4	18.1	1.3	6.2
CRYPTOMONAS SP	84.5	91.5	81.0	161.9	133.8	49.3	42.2
CHODOMONAS MINUTA	17.6	43.1	47.3	37.8	27.7	16.7	24.6
CRYPTOPHYTA TYPE 2	.0	.0	2.2	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	148.0	.0	.0	70.0	.0	.0
PERIDINIUM SP	99.6	66.4	.0	.0	.0	33.2	.0
TOTALS FOR ALL SPECIES	419.9	604.3	458.7	529.3	652.6	410.3	192.3

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**3)

	SEPT 23 1981 ABIE LAKE	SEPT 23 1981 MARMION LAKE -ANDERSON DAM	SEPT 23 1981 MARMION LAKE -LOWER SEINE BAY	SEPT 23 1981 MARMION LAKE -CENTRAL	SEPT 23 1981 MARMION LAKE -NORTH	SEPT 23 1981 MARMION LAKE -SOUTH	OCT. 23 1981 ABIE LAKE
ANABAENA SP	.0	.0	.0	10.7	33.8	1.3	0
ANABAENA FLOS-AQUAE	.0	.0	.0	.0	.0	.0	0
ANACYSTIS SP	.0	.0	.7	.0	.0	.0	0
APHANIZOMENON FLOS-AQUAE	.0	.0	44.1	10.6	19.8	17.2	0
APHANOCAPSA SP	.0	.0	.0	.0	.0	.0	0
CHROOCOCCUS SP	.0	.0	27.8	36.0	48.6	.0	0
CHROOCOCCUS DISPERSUS	.0	.0	117.8	.0	.0	.0	0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	.0	0
MICROCYSTIS SP	.0	.0	.0	.0	.0	.0	0
OSCILLATORIA SPP	.0	.0	.0	.0	.0	189.2	0
COELOSPHAERIUM SP A	.0	.0	5.6	.0	.0	.0	0
COELOSPHAERIUM SP B	.0	.0	.0	.0	3.9	.0	0
CHROOCOCCUS SP B	.0	.0	8.1	.0	.0	.0	0
ANABAENA PLANCTONICA	3.4	21.6	64.3	.0	.0	.0	0
ANKISTRODESMUS FALCATUS	.3	.0	.0	.0	.0	.0	0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.0	.0	.0	.0	.0	0
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	0
COSMARIUM SP	.0	.0	.0	.0	.0	.0	0
CRUCIGENIA SP	.0	.0	.0	.0	.0	.0	0
ELAKATOTHRIX GELATINOSA	.0	.0	.5	.0	.4	.4	0
KIRCHNERIELLA SP	.0	.0	.0	.0	.0	.0	0
MICRACTINIUM SP	.0	.0	11.2	.0	.0	.8	0
MICRACTINIUM PUSILLUM	.0	.0	1.8	.0	.0	.0	0
OOCYSTIS SP	.0	.0	1.3	.0	.0	.0	0
SCENEDESMUS BIJUGA	.0	.0	.2	.0	.2	.0	.2
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.6	.0	.0
SELENASTRUM SP	2.8	.0	.6	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
*STAURASTRUM SP	.0	.0	.0	6.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	0
UNIDENTIFIED 3	8.3	.0	5.4	2.2	19.8	.0	4.0
STAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.0	0
QUADRIGULA SP	.0	.0	.0	.0	.3	.0	.0
HAEMATOCOCCUS SP	.2	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	.0	.0	0
ASTERIONELLA GRACILLIMA	10.2	.0	49.9	29.4	70.4	.0	12.8
CYMBELLA SP	.0	.0	.0	.0	.0	.0	0
DIATOMA SP	.0	.0	.0	.0	.0	.0	0
DIATOMA ELONGATUM	.0	6.8	.0	.0	2.4	2.4	2.4
FRAGILARIA SP	.0	.0	.0	.0	.0	.0	0
FRAGILARIA CROTONENSIS	.0	.0	.0	.0	.0	.0	0
NAVICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	4.0
SYNEDRA SP	.0	6.0	.0	.0	.0	.0	0
SYNEDRA ULNA	.0	.0	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	5.0
TABELLARIA FENESTRATA	.0	.0	57.5	.0	50.0	5.0	4.0
PENNALES	.0	.0	3.8	.0	.0	.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.0	.0	.0
MELOSIRA SP	.0	.0	.0	.0	.0	.0	0
MELOSIRA GRANULATA	273.5	127.2	152.6	289.9	25.4	.0	636.0
RHIZOSOLENIA SP	24.0	6.0	24.0	12.0	42.0	.0	12.0
STEPHANODISCUS SP	.2	.0	.0	.0	.0	.0	.0
DINOBRYON SP	19.0	.4	9.5	5.7	3.4	2.7	13.3
DINOBRYON DIVERGENS	.0	.0	60.7	.0	.0	.0	0
MALLOMONAS SP	4.1	.0	6.1	16.3	53.0	.0	4.1
OCHROMONAS SP	.0	.0	.0	.0	.0	.0	5.1
CHRYSOPHYTA TYPE 1	.0	.0	27.5	15.4	3.9	1.1	2.2
DINOBRYON SERTULARIA	.0	3.4	38.0	.0	17.1	.0	4.6
DINOBRYON BAVARICUM	.0	.0	.0	.0	35.0	.0	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0	.0	.0
BITRICHIA CHODATTI	.2	.0	.0	.0	.0	.0	.0
CRYPTOPHYTA TYPE 1	2.2	.0	13.9	1.7	1.3	4.0	4.8
CRYPTOMONAS SP	190.1	316.8	158.4	112.6	197.1	478.7	373.1
RHODOMONAS MINUTA	36.1	41.8	60.5	65.1	73.5	132.9	73.5
CRYPTOPHYTA TYPE 2	.4	.0	.0	.0	.0	.0	0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	.0	.0	0
PERIDINIUM SP	66.4	.0	.0	.0	33.2	.0	.0
TOTALS FOR ALL SPECIES	642.1	526.0	948.6	533.6	735.2	755.6	1161.0

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**M)

	OCT. 23 1981 MARMION LAKE -LOWER SEINE BAY	OCT. 23 1981 MARMION LAKE -SOUTH	OCT. 24 1981 MARMION LAKE -CENTRAL	OCT. 24 1981 MARMION LAKE -NORTH	OCT. 28 1981 MARMION LAKE -ANDERSON DAM	NOV. 2 1981 ICY LAKE	NOV. 2 1981 MOOSE LAKE
ANABAENA SP	.0	.0	19.2	10.4	.0	.0	2.3
ANABAENA FLOS-AQUAE	.0	.0	.0	.0	.0	.0	.0
ANACYSTIS SP	.7	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	23.9	4.6	2.0	60.7	3.8	.0	5.9
APHANOCAPSA SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	.0	.0	.0	.0	.0	102.0
OSCILLATORIA SPP	.0	.0	.0	.0	.0	1.8	.0
COELOSPHAERIUM SP A	4.5	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0	.0	.0
ANABAENA PLANCTONICA	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.3	7.5	.3	.1	.0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.0	.0	.0	.0	.0	.0
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	.0
COSMARIUM SP	.0	.0	.0	.0	.0	.0	.0
CRUCIGENIA SP	.0	.0	.0	.0	.0	.0	.0
ELAKATOTHRIX GELATINOSA	.0	4.8	.0	4.0	.0	.0	.0
KIRCHNERIELLA SP	.0	.0	.0	.0	.0	.0	.6
MICRACTINIUM SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
OOCYSTIS SP	.0	.0	.0	1.6	.2	.3	.0
SCENEDESMUS BIJUGA	.0	.0	.0	.0	.0	.0	.3
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	25.6	.0	2.6	9.0
ASTERIONELLA GRACILLIMA	21.8	5.1	.0	.0	.0	2.0	.0
CYMBELLA SP	2.0	.0	.0	.0	.0	.0	.8
DIATOMA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	.0	.0	1.5	.0
FRAGILARIA SP	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA CROTONENSIS	.0	.0	.0	.0	.0	.0	.0
RHOICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	.0
SYNEDRA SP	.0	.0	.0	.0	.0	.0	.0
SYNEDRA ULNA	.0	4.0	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	.0	110.0	50.0	200.0	10.0	.0	.0
PENNALES	8.0	.0	.0	20.0	2.0	8.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.9	.0	.0
MELOSIRA SP	.0	.0	.0	233.0	.0	9.3	.0
MELOSIRA GRANULATA	356.2	1469.2	3739.7	1208.4	82.7	.0	.0
RHIZOSOLENIA SP	.0	.0	.0	.0	.0	.0	6.0
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	10.3	.8	.8	1.9	3.4	3.4	3.8
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	4.1	.0	.0	.0	.0	.0	8.2
OCHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	9.9	.0	.0	.0	.0	.0	9.9
DINOBRYON SERTULARIA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON BAVARICUM	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0	.0	.0
BITRICHIA CHODATTI	.0	.0	.0	6.6	.0	.9	2.6
CRYPTOPHYTA TYPE 1	.9	1.8	.0	140.8	.0	77.4	345.0
CRYPTOMONAS SP	260.5	366.1	246.4	74.8	7.5	11.0	95.5
RHODOMONAS MINUTA	65.6	64.7	31.2	.0	.0	.0	.0
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	.0	.0	.0
PERIDINIUM SP	.0	.0	.0	.0	.0	.0	.0
TOTALS FOR ALL SPECIES	768.2	2031.0	4089.6	1995.3	111.5	118.3	591.9

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**M)

	OCT. 23 1981 MARMION LAKE -LOWER SEINE BAY	OCT. 23 1981 MARMION LAKE -SOUTH	OCT. 24 1981 MARMION LAKE -CENTRAL	OCT. 24 1981 MARMION LAKE -NORTH	OCT. 28 1981 MARMION LAKE -ANDERSON DAM	NOV. 2 1981 ICY LAKE	NOV. 2 1981 MOOSE LAKE
ANABAENA SP	.0	.0	19.2	10.4	.0	.0	2.3
ANABAENA FLOS-AQUAE	.0	.0	.0	.0	.0	.0	.0
ANACYSTIS SP	.0	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	.7	.0	2.0	60.7	3.5	.0	5.9
APHANOCAPSA SP	23.9	4.6	.0	.0	.0	.0	.0
CHROOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	.0	.0	.0	.0	.0	102.0
OSCILLATORIA SPP	.0	.0	.0	.0	.0	1.8	.0
COELOSPHAERIUM SP A	4.5	.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0	.0	.0
ANABAENA PLANCTONICA	.0	.0	.3	7.5	.3	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.0	.1	.0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.0	.0	.0	.0	.0	.0
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	.0
COSMARIUM SP	.0	.0	.0	.0	.0	.0	.0
CRUCIGENIA SP	.0	.0	.0	.0	.0	.0	.0
ELAKATOTHRIX GELATINOSA	.0	4.8	.0	4.0	.0	.0	.0
KIRCHNERIELLA SP	.0	.0	.0	.0	.5	.0	.6
MICRACTINIUM SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
OOCYSTIS SP	.0	.0	.0	1.6	.2	.3	.0
SCENEDESMUS BIJUGA	.0	.0	.0	.0	.0	.0	.3
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	25.6	.0	2.6	9.0
ASTERIONELLA GRACILLIMA	21.8	5.1	.0	.0	.0	2.0	.0
CYMBELLA SP	2.0	.0	.0	.0	.0	.0	.8
DIATOMA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	.0	.0	1.5	.0
FRAGILARIA SP	.0	.0	.0	.0	.0	.0	.0
FRAGILARIA CROTONENSIS	.0	.0	.0	.0	.0	.0	.0
RHOICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	.0
SYNEDRA SP	.0	.0	.0	.0	.0	.0	.0
SYNEDRA ULNA	.0	4.0	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	.0	110.0	50.0	200.0	10.0	.0	.0
PENNALES	8.0	.0	.0	20.0	2.0	8.0	.0
CYCLOTELLA SP	.0	.0	.0	.0	.9	.0	.0
MELOSIRA SP	.0	.0	.0	233.0	.0	9.3	.0
MELOSIRA GRANULATA	356.2	1469.2	3739.7	1208.4	82.7	.0	.0
RHIZOSOLENIA SP	.0	.0	.0	.0	.0	.0	6.0
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	10.3	.8	.3	1.9	3.4	3.4	3.8
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	4.1	.0	.0	.0	.0	.0	8.2
OCHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	9.9	.0	.0	.0	.0	.0	9.9
DINOBRYON SERTULARIA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON BAVARICUM	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0	.0	.0
BITRICHIA CHODATTI	.0	.0	.0	6.6	.0	.9	2.6
CRYPTOPHYTA TYPE 1	.9	1.8	.0	.0	.0	77.4	345.0
CRYPTOMONAS SP	260.5	366.1	246.4	140.8	7.5	11.0	95.5
RHODOMONAS MINUTA	65.6	64.7	31.2	74.8	.0	.0	.0
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	.0	.0	.0
PERIDINIUM SP	.0	.0	.0	.0	.0	.0	.0
TOTALS FOR ALL SPECIES	768.2	2031.0	4089.6	1995.3	111.5	118.3	591.5

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**M**M)

	NOV. 2 1981 SNOW LAKE	NOV. 2 1981 SLUSH LAKE	FEB. 1 1982 ABIE LAKE	FEB. 1 1982 MARMION LAKE -ANDERSON DAM	FEB. 1 1982 ICY LAKE	FEB. 1 1982 MARMION LAKE -LOWER SEIME BAY	FEB. 1 1982 MARMION LAKE -CENTRAL
ANABAENA SP	8.3	.0	.0	.0	.0	.0	.0
ANABAENA FLOS-AQUAE	.0	.0	.0	.0	.0	.0	.0
ANACYSTIS SP	.0	.0	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	.0	.0	.0	7.9	2.6	.0	.0
APHANOCAPSA SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	7.0	.0	.0	.0	.0	.0
OSCILLATORIA SPP	.0	48.0	.0	.0	.0	.0	.0
COELOSPHAERIUM SP A	.0	8.1	.0	.0	.0	.0	.0
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	36.0	.0	.0	.0	.0	.0
ANABAENA PLANCTONICA	.0	.0	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	.6	.6	.0
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.1	1.2	.0	.0	.0	.0	.0
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	7.4	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0	.0	.0
COSMARIUM SP	13.2	39.6	.0	.0	.0	.0	.0
CRUCIGENIA SP	.0	.0	.0	.0	.0	.0	.0
ELAKATOTHRIX GELATINOSA	.0	.0	.0	.0	.0	.0	.0
KIRCHNERIELLA SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM SP	.0	.0	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0	.0	.0
OOCYSTIS SP	2.0	.0	.0	.0	.0	.0	.0
SCENEDESMUS BIJUGA	.6	.0	.0	.0	.0	.0	.0
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0	1.9	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0	.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.9	.0	.0	.0	.0	.0	.0
ASTERIONELLA GRACILLIMA	1.3	.0	.0	.0	2.0	.0	.0
CYMBELLA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA SP	.0	.0	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	2.4	.0	.0	.0	.0	.0	.0
FRAGILARIA SP	1.5	.0	.0	.0	.0	.0	.0
FRAGILARIA CROTONENSIS	.0	.0	.0	.0	.0	.0	.0
RHOICOSPHENIA CURVATA	.0	.0	.0	.0	.0	.0	.0
SYNEDRA SP	6.0	.0	5.0	.0	6.0	.0	.0
SYNEDRA ULNA	.0	.0	.0	.0	.0	.0	.0
TABELLARIA SP	2.0	.0	.0	.0	.0	30.0	.0
TABELLARIA FENESTRATA	.0	.0	.0	.0	.0	.0	.0
PENNALES	36.0	4.0	10.0	.0	14.0	26.0	.0
CYCLOTELLA SP	.0	.0	.0	3.6	.0	.0	.0
MELOSIRA SP	79.2	.0	58.0	.0	.0	92.8	.0
MELOSIRA GRANULATA	235.3	.0	.0	.0	.0	.0	.0
RHIZOSOLENIA SP	.0	.0	.0	.0	.0	.0	.0
STEPHANODISCUS SP	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SP	.4	7.2	.0	.0	.0	.0	.0
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS SP	.0	12.2	.0	.0	.0	.0	.0
OCHROMONAS SP	.0	.0	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	.0	.0	.0	.0	.0	.0	.0
DINOBRYON SERTULARIA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON BAVARICUM	.0	.0	.0	.0	.0	.0	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0	.0	.0
BITRICHIA CHODATTI	.0	.0	.0	.0	.0	.0	.0
CRYPTOPHYTA TYPE 1	.0	9.7	.0	3.5	1.3	.0	.0
CRYPTOMONAS SP	91.5	408.3	105.6	42.2	21.1	154.9	176.0
RHODOMONAS MINUTA	16.3	27.3	34.1	11.4	5.3	22.0	28.6
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	.0	.0	.0
PERIDINIUM SP	.0	.0	.0	.0	.0	.0	.0
TOTALS FOR ALL SPECIES	497.1	608.7	212.7	68.7	60.3	328.2	204.6

APPENDIX

SPECIES COMPOSITION OF PHYTOPLANKTON SAMPLES COLLECTED

USING 3 M. INTEGRATED TUBE IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO FEB. 28 1982

VALUES ARE EXPRESSED AS BIOMASS (MG/M**M)

	FEB. 1 1982 MOOSE LAKE	FEB. 1 1982 MARMION LAKE -NORTH	FEB. 1 1982 MARMION LAKE -SOUTH	FEB. 1 1982 SNOW LAKE	FEB. 1 1982 SLUSH LAKE
ANABAENA SP	.0	.0	.0	.0	.0
ANABAENA FLOS-AQUAE	.0	.0	.0	.0	.0
ANACYSTIS SP	.0	.0	.0	.0	.0
APHANIZOMENON FLOS-AQUAE	.0	26.9	7.9	.0	.0
APHANOCAPSA SP	.0	.0	.0	.0	.0
CHROOCOCCUS SP	.0	.0	.0	.0	.0
CHROOCOCCUS DISPERSUS	.0	.0	.0	.0	.0
LYNGBYA SP	.0	.0	.0	.0	.0
MERISMOPEDIA SP	.0	.0	.0	.0	.0
MICROCYSTIS SP	.0	.0	.0	.0	37.5
OSCILLATORIA SPP	615.0	.0	.0	.0	.0
COELOSPHAERIUM SP A	.0	.0	.0	.0	.0
COELOSPHAERIUM SP B	.0	.0	.0	.0	.0
CHROOCOCCUS SP B	.0	.0	.0	.0	.0
ANABAENA PLANCTONICA	.0	.0	.0	.0	.0
ANKISTRODESMUS FALCATUS	.0	.0	.0	.0	1.4
ANKISTRODESMUS FALCATUS VAR MIRABILIS	.0	.0	.0	.0	.0
ASTEROCOCCUS SUPERBUS	.0	.0	.0	.0	.0
COELASTRUM SP	.0	.0	.0	.0	.0
COSMARIUM SP	.0	.0	.0	.0	.0
CRUCIGENIA SP	.0	.0	.0	.0	.0
ELAKATOTHRIX GELATINOSA	.0	.0	.0	.0	.0
KIRCHNERIELLA SP	.0	.0	.0	.0	.0
MICRACTINIUM SP	.0	.0	.0	.0	.0
MICRACTINIUM PUSILLUM	.0	.0	.0	.0	.0
OOCYSTIS SP	.0	.0	.0	.0	.0
SCENEDESMUS BIJUGA	.0	.0	.0	.0	.0
SCENEDESMUS QUADRICAUDA	.0	.0	.0	.0	.0
SELENASTRUM SP	.0	.0	.0	.0	.0
SPONDYLOSIUM SP	.0	.0	.0	.0	.0
STAURASTRUM SP	.0	.0	.0	.0	.0
TETRAEDRON MINIMUM	.0	.0	.0	.0	.0
UNIDENTIFIED 3	.0	.0	.0	.0	.0
STRAURASTRUM LONGISPINA	.0	.0	.0	.0	.0
SPONDYLOSIUM PLANUM	.0	.0	.0	.0	.0
QUADRIGULA SP	.0	.0	.0	.0	.0
HAEMATOCOCCUS SP	.0	.0	.0	.0	.0
ASTERIONELLA FORMOSA	.0	.0	.0	.0	.0
ASTERIONELLA GRACILLIMA	.0	.0	.0	.0	.0
CYMBELLA SP	.0	.0	.0	.0	.0
DIATOMA SP	.0	.0	.0	.0	.0
DIATOMA ELONGATUM	.0	.0	.0	.0	.0
FRAGILARIA SP	.0	.0	.0	.0	.0
FRAGILARIA CROTONENSIS	.0	.0	.0	.0	.0
RHOICOSPHENIA CURVATA	.0	.0	.0	.0	.0
SYNEDRA SP	.0	.0	.0	.0	.0
SYNEDRA ULNA	.0	.0	.0	.0	.0
TABELLARIA SP	.0	.0	.0	.0	.0
TABELLARIA FENESTRATA	.0	.0	.0	.0	30.0
PENNALES	.0	.0	.0	.0	.0
CYCLOTELLA SP	9.0	.0	.0	.0	.0
MELOSIRA SP	186.4	.0	.0	.0	.0
MELOSIRA GRANULATA	.0	.0	.0	.0	.0
RHIZOSOLENIA SP	.0	.0	.0	.0	.0
STEPHANODISCUS SP	.0	.9	.0	.0	3.8
DINOBRYON SP	.0	.0	.0	.0	.0
DINOBRYON DIVERGENS	.0	.0	.0	.0	.0
MALLOMONAS SP	.0	.0	.0	.0	.0
OCHROMONAS SP	.0	.0	.0	.0	.0
CHRYSOPHYTA TYPE 1	.0	.0	.0	.0	.0
DINOBRYON SERTULARIA	.0	.0	.0	.0	.0
DINOBRYON BAVARICUM	.0	.0	.0	.0	.0
MALLOMONAS PSEUDOCORONATA	.0	.0	.0	.0	.0
DINOBRYON CRENULATUM	.0	.0	.0	.0	.0
BITRICHIA CHODATTI	.0	.0	.0	11.0	4.4
CRYPTOPHYTA TYPE 1	.0	.0	176.0	176.0	70.4
CRYPTOMONAS SP	148.8	176.0	30.8	55.0	22.0
RHODOMONAS MINUTA	11.0	20.9	.0	.0	.0
CRYPTOPHYTA TYPE 2	.0	.0	.0	.0	.0
CERATIUM HIRUNDINELLA	.0	.0	.0	.0	.0
PERIDINIUM SP	.0	.0	.0	.0	.0
TOTALS FOR ALL SPECIES	962.2	224.7	214.7	242.0	169.5

APPENDIX 7

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	JUNE 4 1981 ABIE LAKE	JUNE 4 1981 MARMION LAKE -ANDERSON DAM	JUNE 4 1981 ICY LAKE	JUNE 4 1981 MARMION LAKE -LOWER SEINE BAY	JUNE 4 1981 MARMION LAKE -CENTRAL	JUNE 4 1981 MOOSE LAKE	JUNE 4 1981 MARMION LAKE -NORTH
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	316444.0	56111.0	177986.0	176889.0	16463.0	36667.0	37500.0
KERATELLA QUADRATA	.0	111.0	4792.0	2666.0	1481.0	111.0	556.0
KERATELLA HIEMALIS	333.0	.0	.0	.0	.0	.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOLTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	34555.0	18783.0	24167.0	68888.0	32778.0	26000.0	45000.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0	.0	.0	278.0
LECANE LUNARIS	.0	.0	.0	.0	.0	.0	.0
LECANE LUNA	.0	.0	.0	.0	.0	.0	.0
LECANE BULA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA CYLINDRICA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA MULTICRINIS	667.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA PORCELLUS	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	5333.0	2593.0	1111.0	9111.0	3889.0	1333.0	3611.0
ASPLANCHNA PRIODONTA	4000.0	741.0	2814.0	1556.0	2037.0	222.0	1669.0
POLYARTHRA SPP	30778.0	3333.0	13125.0	39555.0	9259.0	2333.0	10278.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	444.0	.0	347.0	444.0	.0	778.0	1389.0
PLOESOMA SPP	.0	.0	.0	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	.0	.0	.0	.0	.0	.0	.0
FILINIA TERMINALIS	.0	.0	.0	.0	.0	.0	.0
FILINIA LONGISETA	.0	.0	69.0	1333.0	.0	1333.0	.0
CONOCHILUS UNICORNIS	.0	2593.0	347.0	2222.0	4259.0	3222.0	2222.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	.0	.0	.0	.0
GASTROPUS SPP	19777.0	3704.0	4931.0	27333.0	13148.0	1667.0	12222.0
GASTROPUS STYLIFER	.0	.0	.0	.0	.0	.0	.0
CONOCHILOIDES DOSSUMARIUS	556.0	12037.0	2500.0	6889.0	9074.0	15000.0	6944.0
HEXARTHRA MIRA	.0	.0	.0	.0	.0	.0	.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0	.0	.0	.0
DIAPHANOSOMA	.0	185.0	.0	.0	.0	.0	139.0
LEUCHTENBERGIANUM							
HOLOPEDIUM GIBBERUM	.0	.0	.0	2444.0	1111.0	111.0	3834.0
DAPHNIA SPP	778.0	741.0	417.0	.0	185.0	333.0	1250.0
DAPHNIA LONGIREMIS	2444.0	741.0	1111.0	444.0	370.0	56.0	278.0
DAPHNIA RETROCURVA	222.0	1111.0	139.0	889.0	185.0	306.0	556.0
DAPHNIA GALEATA MENDOTAE	10111.0	5184.0	4444.0	2000.0	1481.0	696.0	2639.0
DAPHNIA PARVULA	333.0	.0	139.0	.0	.0	56.0	.0
DAPHNIA PULEX	.0	.0	.0	.0	.0	.0	.0
DAPHNIA AMBIGUA	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	.0	.0	.0	.0	.0	.0	278.0
BOSMINA LONGIROSTRIS	333.0	3519.0	208.0	889.0	1296.0	3250.0	1111.0
EUBOSMINA COREGONI	.0	.0	.0	.0	.0	.0	.0
CHYDORUS SPHAERICUS	.0	.0	.0	.0	.0	.0	.0
DIAPTOMUS OREGONENSIS	2778.0	3148.0	1181.0	5111.0	6111.0	250.0	2639.0
DIAPTOMUS MINUTUS	1222.0	370.0	694.0	2000.0	1481.0	83.0	1111.0
DIAPTOMUS SICILIS	.0	.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	1111.0	5185.0	2569.0	12444.0	3333.0	556.0	2778.0
CALANOIDA COPEPODITE STAGES	1333.0	2222.0	1667.0	6444.0	3889.0	111.0	4028.0
CYCLOPS BICUSPIDATUS THOMASI	3889.0	5740.0	2777.0	26000.0	13333.0	500.0	5972.0
MESOCYCLOPS EDAX	556.0	1111.0	625.0	889.0	1296.0	28.0	417.0
CYCLOPOIDA NAUPLIAR STAGES	2667.0	7963.0	4167.0	16000.0	8889.0	1500.0	4583.0
CYCLOPOIDA COPEPODITE STAGES	8333.0	26296.0	12639.0	31556.0	27593.0	500.0	15000.0
TOTALS FOR ALL SPECIES	448997.0	163442.0	264166.0	443108.0	162941.0	97002.0	170282.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	JUNE 4 1981 MARMION LAKE -SOUTH	JUNE 4 1981 SNOW LAKE	JUNE 5 1981 POTHERINGHAM LAKE	JUNE 22 1981 ABIE LAKE	JUNE 22 1981 MARMION LAKE -ANDERSON DAM	JUNE 22 1981 POTHERINGHAM LAKE	JUNE 22 1981 ICY LAKE
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	222.0	139.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	207639.0	93111.0	20139.0	21851.0	16667.0	209445.0	16343.0
KERATELLA QUADRATA	1250.0	889.0	.0	278.0	476.0	.0	1574.0
KERATELLA HIEMALIS	.0	.0	.0	.0	.0	.0	93.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	33612.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOLTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	22500.0	4667.0	.0	6112.0	3730.0	1111.0	14398.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	.0	.0	.0	.0
LECANE LUNA	.0	.0	.0	.0	.0	.0	.0
LECANE BULA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	1389.0	.0
TRICHOCERCA CYLINDRICA	.0	.0	.0	185.0	.0	278.0	.0
TRICHOCERCA MULTICRINIS	.0	.0	.0	556.0	79.0	.0	231.0
TRICHOCERCA PORCELLUS	.0	.0	.0	93.0	.0	1389.0	46.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	8750.0	667.0	1111.0	6852.0	476.0	32500.0	3843.0
ASPLANCHNA PRIODONTA	1250.0	1330.0	9862.0	.0	.0	.0	.0
POLYARTHRA SPP	3750.0	.0	9445.0	6481.0	3492.0	43333.0	4768.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	.0	.0	.0	185.0	.0	1944.0	.0
PLOESOMA SPP	.0	.0	.0	.0	.0	833.0	.0
PLOESOMA TRIACANTHUM	.0	.0	.0	1204.0	.0	3333.0	185.0
PILINIA TERMINALIS	.0	.0	.0	.0	.0	.0	.0
PILINIA LONGISETA	139.0	222.0	139.0	.0	159.0	.0	.0
CONOCHILUS UNICORNIS	694.0	.0	278.0	93.0	476.0	556.0	93.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	278.0	.0
ASCOMORPHA SPP	.0	.0	.0	556.0	.0	833.0	370.0
GASTROPUS SPP	9028.0	10889.0	3194.0	3704.0	1429.0	7778.0	1296.0
GASTROPUS STYLIFER	.0	.0	.0	.0	.0	.0	.0
CONOCHILOIDES DOSSUMARIUS	3750.0	444.0	.0	.0	714.0	833.0	139.0
HEXARTHRA MIRA	.0	.0	.0	.0	.0	278.0	.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	1250.0	185.0	.0	833.0	.0
DIAPHANOSOMA LEUCHTENBERGIANUM	.0	111.0	.0	.0	.0	.0	.0
HOLOPEDIUM GIBBERUM	139.0	.0	278.0	93.0	.0	4328.0	.0
DAPHNIA SPP	.0	111.0	.0	648.0	238.0	2708.0	370.0
DAPHNIA LONGIREMIS	139.0	112.0	.0	833.0	317.0	417.0	278.0
DAPHNIA RETROCURVA	.0	111.0	.0	.0	238.0	278.0	93.0
DAPHNIA GALEATA MENDOTAE	695.0	889.0	.0	2408.0	3650.0	1250.0	2269.0
DAPHNIA PARVULA	.0	.0	.0	.0	79.0	.0	.0
DAPHNIA PULEX	.0	.0	.0	.0	.0	902.0	694.0
DAPHNIA AMBIGUA	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	.0	.0	.0	.0	.0	.0	46.0
BOSMINA LONGIROSTRIS	1250.0	666.0	973.0	556.0	319.0	486.0	231.0
EUBOSMINA COREGONI	.0	.0	.0	.0	.0	.0	.0
CHYDORUS SPHAERICUS	.0	.0	.0	.0	.0	.0	.0
DIAPTOMUS OREGONENSIS	4167.0	2278.0	278.0	1944.0	2381.0	69.4	370.0
DIAPTOMUS MINUTUS	833.0	.0	139.0	648.0	1190.0	208.0	417.0
DIAPTOMUS SICILIS	.0	.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	5417.0	333.0	833.0	5278.0	4444.0	1458.0	2315.0
CALANOIDA COPEPODITE STAGES	5139.0	333.0	139.0	185.0	317.0	278.0	185.0
CYCLOPS BICUSPIDATUS THOMASI	6806.0	2056.0	1528.0	2315.0	1746.0	.0	370.0
MESOCYCLOPS EDAX	1111.0	56.0	.0	833.0	556.0	417.0	139.0
CYCLOPOIDA NAUPLIAR STAGES	16389.0	556.0	1944.0	8981.0	7540.0	2847.0	463.0
CYCLOPOIDA COPEPODITE STAGES	38750.0	1556.0	1111.0	648.0	1667.0	556.0	556.0
TOTALS FOR ALL SPECIES	339585.0	121609.0	52780.0	73705.0	52380.0	356458.0	52175.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	JUNE 22 1981 MARMION LAKE -LOWER SEINE BAY	JUNE 22 1981 MARMION LAKE -CENTRAL	JUNE 22 1981 MOOSE LAKE	JUNE 22 1981 MARMION LAKE -SOUTH	JUNE 22 1981 SNOW LAKE	JUNE 22 1981 SLUSH LAKE	JUNE 23 1981 MARMION LAKE -NORTH
BRACHIONUS SPP	.0	.0	.0	.0	93.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	18738.0	16278.0	15859.0	21778.0	48556.0	1358.0	11975.0
KERATELLA QUADRATA	.0	.0	.0	167.0	556.0	371.0	123.0
KERATELLA HIEMALIS	.0	.0	.0	.0	.0	432.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOLTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	4849.0	3895.0	9497.0	2611.0	4537.0	5247.0	2899.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	.0	.0	.0	.0
LECANE LUNA	.0	.0	.0	.0	.0	.0	.0
LECANE BULA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	62.5	.0
TRICHOCERCA CYLINDRICA	484.0	.0	58.0	222.0	.0	185.0	.0
TRICHOCERCA MULTICRINIS	.0	159.0	101.0	111.0	648.0	.0	.0
TRICHOCERCA PORCELLUS	.0	79.0	.0	.0	.0	.0	.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	93.0	.0	.0
ASPLANCHNA SPP	1465.0	873.0	966.0	833.0	926.0	864.0	432.0
ASPLANCHNA PRIODONTA	.0	.0	.0	.0	.0	370.0	.0
POLYARTHRA SPP	.0	5715.0	1667.0	5500.0	10278.0	3086.0	4012.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	354.0	79.0	606.0	56.0	93.0	62.0	.0
PLOESOMA SPP	.0	.0	.0	.0	556.0	.0	.0
PLOESOMA TRIACANTHUM	.0	.0	.0	.0	.0	.0	.0
FILINIA TERMINALIS	.0	.0	.0	.0	93.0	.0	.0
FILINIA LONGISETA	.0	.0	858.0	56.0	185.0	4198.0	.0
CONOCHILUS UNICORNIS	501.0	238.0	1566.0	556.0	463.0	309.0	494.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	101.0	.0	.0	56.0	.0	.0	.0
GASTROPUS SPP	1667.0	2143.0	383.0	1278.0	.0	556.0	370.0
GASTROPUS STYLIFER	.0	714.0	50.0	.0	833.0	.0	.0
CONOCHILOIDES	606.0	397.0	5051.0	722.0	833.0	309.0	.0
DOSSUMARIUS							
HEXARTHRA MIRA	.0	.0	.0	.0	.0	.0	.0
POMPHOLYX SPP	.0	.0	.0	.0	1759.0	.0	.0
COLLOTHECA PELAGICA	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	159.0	.0	.0	1204.0	.0	.0
DIAPHANOSOMA	.0	.0	.0	.0	556.0	123.0	.0
LEUCHTENBERGIANUM							
HOLOPEDIUM GIBBERUM	101.0	317.0	.0	.0	463.0	864.0	.0
DAPHNIA SPP	252.0	317.0	202.0	111.0	463.0	370.0	.0
DAPHNIA LONGIREMIS	858.0	.0	50.0	111.0	93.0	62.0	154.0
DAPHNIA RETROCURVA	.0	159.0	101.0	.0	.0	.0	93.0
DAPHNIA GALEATA MENDOTAE	1616.0	1904.0	3131.0	333.0	556.0	926.0	1285.0
DAPHNIA PARVULA	50.0	.0	.0	56.0	.0	.0	.0
DAPHNIA PULEX	101.0	.0	.0	167.0	.0	62.0	93.0
DAPHNIA AMBIGUA	.0	.0	.0	56.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	.0	.0	.0	.0	.0	.0	.0
BOSMINA LONGIROSTRIS	201.0	317.0	4039.0	333.0	556.0	494.0	247.0
EUBOSMINA COREGONI	.0	.0	50.0	111.0	.0	.0	.0
CHYDORUS SPHAERICUS	.0	.0	.0	.0	.0	.0	.0
DIAPTOMUS OREGONENSIS	1465.0	1904.0	556.0	444.0	3149.0	3395.0	370.0
DIAPTOMUS MINUTUS	707.0	.0	303.0	278.0	463.0	.0	.0
DIAPTOMUS SICILIS	.0	317.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	6515.0	1429.0	404.0	3556.0	1944.0	3704.0	31.0
CALANOIDA COPEPODITE STAGES	354.0	317.0	50.0	333.0	278.0	1605.0	123.0
CYCLOPS BICUSPIDATUS THOMASI	1414.0	2539.0	757.0	1340.0	1668.0	4568.0	883.0
MESOCYCLOPS EDAX	1263.0	794.0	253.0	1167.0	278.0	679.0	431.0
CYCLOPOIDA NAUPLIAR STAGES	4891.0	3254.0	1465.0	4944.0	4630.0	7099.0	1358.0
CYCLOPOIDA COPEPODITE STAGES	101.0	1349.0	253.0	556.0	463.0	3395.0	309.0
TOTALS FOR ALL SPECIES	47815.0	44838.0	48388.0	47842.0	79266.0	44755.0	24692.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	JULY 28 1981 MARMION LAKE -LOWER SEINE BAY	JULY 28 1981 MOOSE LAKE	JULY 28 1981 SNOW LAKE	JULY 29 1981 ICY LAKE	JULY 30 1981 ABIE LAKE	JULY 30 1981 MARMION LAKE -ANDERSON DAM	JULY 30 1981 MARMION LAKE -CENTRAL
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0	.0	278.0	.0
KERATELLA COCHLEARIS	5798.0	2994.0	3528.0	8472.0	40223.0	18333.0	6111.0
KERATELLA QUADRATA	28.0	51.0	.0	185.0	222.0	184.0	119.0
KERATELLA HIEMALIS	.0	.0	28.0	93.0	.0	185.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	46.0	.0	.0	.0
NOLTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	445.0	1212.0	1416.0	2361.0	12888.0	3148.0	596.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	46.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	.0	.0	.0	.0
LECANE LUNA	.0	.0	56.0	.0	.0	.0	.0
LECANE BULA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA CYLINDRICA	111.0	.0	167.0	.0	.0	93.0	119.0
TRICHOCERCA MULTICRINIS	56.0	.0	386.0	.0	667.0	926.0	48.0
TRICHOCERCA PORCELLUS	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	.0	.0	231.0	444.0	.0	.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	361.0	202.0	944.0	787.0	1778.0	1852.0	397.0
ASPLANCHNA PRIODONTA	.0	25.0	944.0	.0	.0	93.0	79.0
POLYARTHRA SPP	1833.0	429.0	917.0	2454.0	3556.0	4815.0	2381.0
POLYARTHRA MINOR	.0	.0	.0	93.0	.0	.0	.0
SYNCHAETA SPP	333.0	51.0	.0	463.0	444.0	93.0	79.0
PLOESOMA SPP	.0	.0	.0	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	278.0	.0	.0	324.0	667.0	.0	159.0
FILINIA TERMINALIS	.0	.0	.0	.0	.0	.0	.0
FILINIA LONGISETA	.0	859.0	.0	.0	889.0	833.0	.0
CONOCHILUS UNICORNIS	861.0	76.0	.0	46.0	2222.0	463.0	794.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	1333.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	231.0	.0	.0	.0
GASTROPUS SPP	667.0	181.0	889.0	46.0	3333.0	926.0	476.0
GASTROPUS STYLIFER	.0	.0	56.0	278.0	.0	.0	.0
CONOCHILOIDES DOSSUMARIUS	386.0	76.0	139.0	.0	8888.0	370.0	1587.0
HEXARTHRA MIRA	.0	.0	.0	324.0	.0	.0	.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	56.0	.0	28.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0	.0	.0	.0
DIAPHANOSOMA LEUCHTENBERGIANUM	56.0	.0	333.0	31.0	2889.0	185.0	556.0
HOLOPEDIUM GIBBERUM	111.0	.0	1222.0	123.0	1333.0	93.0	873.0
DAPHNIA SPP	278.0	126.0	557.0	31.0	.0	556.0	317.0
DAPHNIA LONGIREMIS	333.0	51.0	111.0	31.0	444.0	93.0	79.0
DAPHNIA RETROCURVA	111.0	228.0	.0	.0	.0	.0	.0
DAPHNIA GALEATA MENDOTAE	1389.0	528.0	1444.0	525.0	3555.0	371.0	1905.0
DAPHNIA PARVULA	.0	.0	.0	.0	444.0	.0	.0
DAPHNIA PULEX	.0	.0	.0	93.0	667.0	.0	159.0
DAPHNIA AMBIGUA	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	222.0	.0	222.0	.0	.0	93.0	79.0
BOSMINA LONGIROSTRIS	1667.0	253.0	333.0	340.0	1555.0	278.0	556.0
EUBOSMINA COREGONI	.0	.0	222.0	31.0	.0	.0	238.0
CHYDORUS SPHAERICUS	.0	.0	333.0	31.0	.0	.0	119.0
DIAPTOMUS OREGONENSIS	556.0	1361.0	4444.0	864.0	1555.0	1945.0	1191.0
DIAPTOMUS MINUTUS	167.0	202.0	667.0	185.0	667.0	370.0	159.0
DIAPTOMUS SICILIS	.0	.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	2278.0	1465.0	3556.0	494.0	27111.0	4332.0	1588.0
CALANOIDA COPEPODITE STAGES	278.0	126.0	667.0	123.0	1333.0	556.0	317.0
CYCLOPS BICUSPIDATUS THOMASI	555.0	530.0	1889.0	432.0	4000.0	3242.0	873.0
MESOCYCLOPS EDAX	167.0	.0	333.0	123.0	889.0	556.0	238.0
CYCLOPOIDA NAUPLIAR STAGES	5167.0	3085.0	1556.0	1080.0	29555.0	4722.0	2778.0
CYCLOPOIDA COPEPODITE STAGES	833.0	303.0	6778.0	154.0	4000.0	1296.0	635.0
TOTALS FOR ALL SPECIES	25253.0	13906.0	34085.0	21171.0	135775.0	51302.0	25597.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	JULY 30 1981 MARMION LAKE -NORTH	JULY 30 1981 MARMION LAKE -SOUTH	AUG. 27 1981 ICY LAKE	AUG. 27 1981 MOOSE LAKE	AUG. 27 1981 SNOW LAKE	AUG. 27 1981 SLUSH LAKE	AUG. 28 1981 ABIE LAKE
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	2281.0	4352.0	26374.0	1566.0	6111.0	880.0	19611.0
KERATELLA QUADRATA	.0	31.0	93.0	26.0	.0	23.0	56.0
KERATELLA HIEMALIS	52.0	.0	.0	.0	.0	12.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOLTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	364.0	1856.0	463.0	76.0	1343.0	173.0	945.0
KELLICOTTIA BOSTONIENSIS	.0	.0	93.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	.0	.0	.0	.0
LECANE LUNA	.0	.0	.0	.0	.0	.0	.0
LECANE BULA	.0	.0	556.0	76.0	93.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA CYLINDRICA	139.0	62.0	.0	.0	46.0	.0	56.0
TRICHOCERCA MULTICRINIS	156.0	154.0	.0	.0	231.0	.0	222.0
TRICHOCERCA PORCELLUS	35.0	62.0	.0	.0	.0	.0	.0
TRICHOCERCA PUSILLA	.0	31.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	123.0	.0	.0	.0	23.0	56.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	156.0	432.0	1444.0	227.0	463.0	104.0	833.0
ASPLANCHNA PRIODONTA	69.0	.0	926.0	.0	.0	23.0	.0
POLYARTHRA SPP	642.0	3856.0	6296.0	51.0	787.0	127.0	944.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	.0	62.0	463.0	.0	.0	23.0	.0
PLOESOMA SPP	.0	.0	.0	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	35.0	154.0	185.0	13.0	.0	.0	56.0
PILINIA TERMINALIS	.0	.0	.0	.0	.0	.0	.0
PILINIA LONGISETA	35.0	.0	278.0	114.0	93.0	58.0	111.0
CONOCHILUS UNICORNIS	174.0	957.0	.0	177.0	278.0	12.0	611.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	.0	.0	.0	.0
GASTROPUS SPP	288.0	463.0	1481.0	51.0	833.0	116.0	944.0
GASTROPUS STYLIFER	.0	.0	.0	.0	.0	.0	.0
CONOCHILOIDES DOSSUMARIUS	104.0	432.0	185.0	38.0	648.0	35.0	389.0
HEXARTHRA MIRA	.0	.0	.0	.0	.0	.0	56.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	93.0	.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0	.0	.0	.0
DIAPHANOSOMA LEUCHTENBERGIANUM	104.0	340.0	463.0	25.0	1574.0	995.0	111.0
HOLOPEDIUM GIBBERUM	70.0	1423.0	1296.0	63.0	556.0	231.0	148.0
DAPHNIA SPP	139.0	340.0	556.0	63.0	.0	46.0	148.0
DAPHNIA LONGIREMIS	35.0	154.0	.0	25.0	93.0	.0	37.0
DAPHNIA RETROCURVA	35.0	154.0	.0	.0	.0	.0	.0
DAPHNIA GALEATA MENDOTAE	313.0	927.0	556.0	140.0	834.0	393.0	1000.0
DAPHNIA PARVULA	.0	.0	463.0	.0	.0	.0	37.0
DAPHNIA PULEX	104.0	.0	.0	.0	.0	.0	.0
DAPHNIA AMBIGUA	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	35.0	31.0	1019.0	13.0	93.0	116.0	.0
BOSMINA LONGIROSTRIS	174.0	957.0	1666.0	89.0	2037.0	444.0	1222.0
EUBOSMINA COREGONI	.0	.0	.0	.0	.0	.0	.0
CHYDORUS SPHAERICUS	.0	93.0	.0	.0	370.0	278.0	.0
DIAPTOMUS OREGONENSIS	521.0	988.0	1667.0	1161.0	3241.0	1180.0	444.0
DIAPTOMUS MINUTUS	139.0	370.0	1019.0	101.0	648.0	139.0	111.0
DIAPTOMUS SICILIS	.0	.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	1736.0	1451.0	5556.0	808.0	3981.0	417.0	1222.0
CALANOIDA COPEPODITE STAGES	174.0	123.0	556.0	152.0	1296.0	139.0	185.0
CYCLOPS BICUSPIDATUS THOMASI	598.0	494.0	3334.0	588.0	4074.0	834.0	852.0
MESOCYCLOPS EDAX	174.0	123.0	463.0	101.0	370.0	152.0	111.0
CYCLOPOIDA NAUPLIAR STAGES	2743.0	2138.0	11481.0	1313.0	7138.0	949.0	2185.0
CYCLOPOIDA COPEPODITE STAGES	417.0	401.0	1944.0	265.0	1667.0	417.0	556.0
TOTALS FOR ALL SPECIES	11953.0	24019.0	71076.0	7314.0	38890.0	8349.0	33259.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	JULY 30 1981 MARMION LAKE -NORTH	JULY 30 1981 MARMION LAKE -SOUTH	AUG. 27 1981 ICY LAKE	AUG. 27 1981 MOOSE LAKE	AUG. 27 1981 SNOW LAKE	AUG. 27 1981 SLUSH LAKE	AUG. 28 1981 ABIE LAKE
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	2281.0	4352.0	26574.0	1566.0	6111.0	888.0	19611.0
KERATELLA QUADRATA	.0	31.0	93.0	26.0	.0	23.0	56.0
KERATELLA HIEMALIS	52.0	.0	.0	.0	.0	12.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOLTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	364.0	3856.0	463.0	76.0	1343.0	173.0	945.0
KELLICOTTIA BOSTONIENSIS	.0	.0	93.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	.0	.0	.0	.0
LECANE LUNA	.0	.0	.0	.0	.0	.0	.0
LECANE BULA	.0	.0	556.0	76.0	93.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA CYLINDRICA	139.0	62.0	.0	.0	46.0	.0	56.0
TRICHOCERCA MULTICRINIS	156.0	154.0	.0	.0	231.0	.0	222.0
TRICHOCERCA PORCELLUS	35.0	62.0	.0	.0	.0	.0	.0
TRICHOCERCA PUSILLA	.0	31.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	123.0	.0	.0	.0	23.0	56.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	156.0	432.0	1444.0	227.0	463.0	184.0	833.0
ASPLANCHNA PRIODONTA	69.0	.0	926.0	.0	.0	23.0	.0
POLYARTHRA SPP	642.0	3856.0	6296.0	51.0	787.0	127.0	944.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	.0	62.0	463.0	.0	.0	23.0	.0
PLOESOMA SPP	.0	.0	.0	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	35.0	154.0	185.0	13.0	.0	.0	56.0
FILINIA TERMINALIS	.0	.0	.0	.0	.0	.0	.0
FILINIA LONGISETA	35.0	.0	278.0	114.0	93.0	58.0	111.0
CONOCHILUS UNICORNIS	174.0	957.0	.0	177.0	278.0	12.0	611.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	.0	.0	.0	.0
GASTROPUS SPP	.0	.0	.0	.0	833.0	116.0	944.0
GASTROPUS STYLIFER	208.0	463.0	1481.0	51.0	.0	.0	.0
CONOCHILOIDES	.0	.0	.0	.0	648.0	35.0	389.0
DOSSUMARIUS	104.0	432.0	185.0	38.0	.0	.0	56.0
HEXARTHRA MIRA	.0	.0	.0	.0	.0	.0	.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	93.0	.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0	.0	.0	.0
DIAPHANOSOMA	104.0	348.0	463.0	25.0	1574.0	995.0	111.0
LEUCHTENBERGIANUM	.0	.0	.0	.0	.0	.0	.0
HOLOPEDIUM GIBBERUM	70.0	1423.0	1296.0	63.0	556.0	231.0	148.0
DAPHNIA SPP	139.0	340.0	556.0	63.0	.0	46.0	148.0
DAPHNIA LONGIREMIS	35.0	154.0	.0	25.0	93.0	.0	37.0
DAPHNIA RETROCURVA	35.0	154.0	.0	.0	.0	.0	.0
DAPHNIA GALEATA MENDOTAE	35.0	927.0	556.0	140.0	834.0	393.0	1300.0
DAPHNIA PARVULA	313.0	.0	463.0	.0	.0	.0	37.0
DAPHNIA PULEX	.0	.0	.0	.0	.0	.0	.0
DAPHNIA AMBIGUA	104.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	.0	.0	.0	.0	93.0	116.0	.0
BOSMINA LONGIROSTRIS	35.0	31.0	1019.0	13.0	2037.0	444.0	1222.0
EUBOSMINA COREGONI	174.0	957.0	1666.0	89.0	.0	.0	.0
CHYDORUS SPHAERICUS	.0	.0	.0	.0	.0	.0	.0
DIAPTOMUS OREGONENSIS	.0	93.0	.0	.0	370.0	278.0	444.0
DIAPTOMUS MINUTUS	521.0	988.0	1667.0	1161.0	3241.0	1188.0	111.0
DIAPTOMUS SICILIS	139.0	370.0	1019.0	101.0	648.0	139.0	.0
CALANOIDA NAUPLIAR STAGES	.0	.0	.0	.0	.0	.0	.0
CALANOIDA COPEPODITE STAGES	1736.0	1451.0	5556.0	808.0	3981.0	417.0	1222.0
CYCLOPS BICUSPIDATUS THOMASI	174.0	123.0	556.0	152.0	1296.0	139.0	155.0
MESOCYCLOPS EDAX	590.0	494.0	3334.0	580.0	4074.0	834.0	852.0
CYCLOPOIDA NAUPLIAR STAGES	174.0	123.0	463.0	101.0	370.0	162.0	111.0
CYCLOPOIDA COPEPODITE STAGES	2743.0	2130.0	11481.0	1313.0	7130.0	949.0	2185.0
TOTALS FOR ALL SPECIES	417.0	401.0	1944.0	265.0	1667.0	417.0	556.0
	11953.0	24019.0	71076.0	7314.0	38890.0	8349.0	33259.0

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APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	AUG. 28 1981 MARMION LAKE -ANDERSON DAM	AUG. 28 1981 MARMION LAKE -LOWER SEINE BAY	AUG. 28 1981 MARMION LAKE -CENTRAL	AUG. 28 1981 MARMION LAKE -NORTH	AUG. 28 1981 MARMION LAKE -SOUTH	SEPT 21 1981 SNOW LAKE	SEPT 22 1981 ICY LAKE
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	48.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	59874.0	2696.0	13215.0	25878.0	3822.0	8223.0	25666.0
KERATELLA QUADRATA	.0	17.0	.0	.0	.0	.0	.0
KERATELLA HIEMALIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOLTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	378.0	51.0	159.0	139.0	.0	334.0	1889.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	.0	51.0	.0	.0
LECANE LUNA	.0	.0	.0	.0	.0	.0	.0
LECANE BULA	463.0	370.0	.0	.0	.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	.0	333.0
TRICHOCERCA CYLINDRICA	370.0	17.0	79.0	288.0	67.0	.0	222.0
TRICHOCERCA MULTICRINIS	556.0	.0	119.0	139.0	.0	.0	.0
TRICHOCERCA PORCELLUS	.0	.0	119.0	.0	34.0	.0	.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	741.0	168.0	1468.0	486.0	724.0	56.0	.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	4445.0	51.0	1825.0	1111.0	387.0	.0	1445.0
ASPLANCHNA PRIODONTA	.0	34.0	.0	.0	.0	.0	.0
POLYARTHRA SPP	7871.0	1810.0	1944.0	2778.0	640.0	2667.0	9110.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	278.0	34.0	79.0	.0	.0	.0	333.0
PLOESOMA SPP	.0	.0	.0	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	.0	101.0	40.0	.0	.0	.0	111.0
PILINIA TERMINALIS	.0	.0	.0	.0	.0	.0	222.0
PILINIA LONGISETA	.0	.0	.0	.0	.0	111.0	111.0
CONOCHILUS UNICORNIS	1574.0	337.0	397.0	417.0	152.0	444.0	333.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	.0	.0	.0	.0
GASTROPUS SPP	2407.0	286.0	1985.0	1886.0	322.0	944.0	2111.0
GASTROPUS STYLIFER	.0	.0	.0	.0	.0	.0	.0
CONOCHILOIDES DOSSUMARIUS	2315.0	673.0	635.0	347.0	51.0	111.0	.0
HEXARTHRA MIRA	185.0	17.0	.0	.0	.0	.0	111.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	17.0	.0	.0	34.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0	.0	.0	.0
DIAPHANOSOMA LEUCHTENBERGIANUM	93.0	135.0	853.0	868.0	316.0	223.0	.0
HOLOPEDIUM GIBBERUM	231.0	101.0	159.0	452.0	152.0	.0	.0
DAPHNIA SPP	278.0	118.0	40.0	139.0	292.0	167.0	74.0
DAPHNIA LONGIREMIS	46.0	101.0	40.0	277.0	38.0	.0	74.0
DAPHNIA RETROCURVA	.0	84.0	298.0	209.0	278.0	56.0	.0
DAPHNIA GALEATA MENDOTAE	324.0	505.0	1052.0	798.0	1932.0	222.0	148.0
DAPHNIA PARVULA	.0	17.0	.0	.0	38.0	.0	.0
DAPHNIA PULEX	.0	.0	.0	.0	.0	.0	.0
DAPHNIA AMBIGUA	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	.0	.0	79.0	35.0	38.0	56.0	111.0
BOSMINA LONGIROSTRIS	2685.0	118.0	615.0	1008.0	152.0	1889.0	1074.0
EUBOSMINA COREGONI	.0	.0	.0	.0	.0	.0	.0
CHYDORUS SPHAERICUS	93.0	34.0	60.0	104.0	25.0	56.0	.0
DIAPTOMUS OREGONENSIS	.0	202.0	338.0	730.0	834.0	2612.0	296.0
DIAPTOMUS MINUTUS	.0	101.0	119.0	104.0	152.0	333.0	259.0
DIAPTOMUS SICILIS	.0	.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	1852.0	859.0	655.0	1250.0	227.0	1222.0	963.0
CALANOIDA COPEPODITE STAGES	463.0	51.0	179.0	243.0	139.0	944.0	185.0
CYCLOPS BICUSPIDATUS THOMASI	1436.0	404.0	596.0	1633.0	669.0	2000.0	1666.0
MESOCYCLOPS EDAX	139.0	51.0	68.0	104.0	88.0	222.0	148.0
CYCLOPOIDA NAUPLIAR STAGES	2407.0	1633.0	972.0	1319.0	568.0	1611.0	1926.0
CYCLOPOIDA COPEPODITE STAGES	1065.0	185.0	575.0	1389.0	354.0	5278.0	852.0
TOTALS FOR ALL SPECIES	91761.0	10576.0	28714.0	43163.0	12736.0	29781.0	49773.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	SEPT 22 1981 MOOSE LAKE	SEPT 22 1981 SLUSH LAKE	SEPT 23 1981 ABIE LAKE	SEPT 23 1981 MARMION LAKE -ANDERSON DAM	SEPT 23 1981 MARMION LAKE -LOWER SEINE BAY	SEPT 23 1981 MARMION LAKE -CENTRAL	SEPT 23 1981 MARMION LAKE -NORTH
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	8319.0	1292.0	7871.0	10856.0	4975.0	14444.0	4298.0
KERATELLA QUADRATA	.0	.0	46.0	.0	.0	.0	.0
KERATELLA HIEMALIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	8887.0	288.0	139.0	889.0	453.0	741.0	154.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0	.0	.0	.0
LEPADELLA SPP	.0	.0	.0	.0	152.0	.0	.0
LECANE SPP	.0	.0	.0	56.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	.0	51.0	556.0	.0
LECANE LUNA	.0	.0	.0	.0	.0	.0	.0
LECANE BULA	1485.0	288.0	.0	.0	.0	741.0	93.0
TRICHOCERCA SPP	.0	.0	.0	.0	.0	.0	31.0
TRICHOCERCA CYLINDRICA	.0	.0	.0	111.0	.0	.0	.0
TRICHOCERCA MULTICRINIS	37.0	.0	.0	167.0	.0	556.0	62.0
TRICHOCERCA PORCELLUS	181.0	.0	46.0	111.0	177.0	648.0	494.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	.0	93.0	.0	25.0	93.0	31.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	788.0	292.0	4630.0	1444.0	1288.0	9444.0	869.0
ASPLANCHNA PRIODONTA	.0	.0	.0	.0	.0	.0	.0
POLYARTHRA SPP	8481.0	625.0	6991.0	5855.0	1591.0	8333.0	1482.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	.0	.0	556.0	278.0	101.0	741.0	93.0
PLOESOMA SPP	.0	.0	.0	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	.0	.0	463.0	167.0	51.0	278.0	.0
FILINIA TERMINALIS	.0	.0	.0	.0	.0	.0	.0
FILINIA LONGISETA	.0	14.0	370.0	.0	.0	.0	.0
CONOCHILUS UNICORNIS	596.0	97.0	185.0	.0	253.0	926.0	556.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	.0	.0	.0	.0
GASTROPUS SPP	1273.0	140.0	3426.0	2222.0	2045.0	11111.0	2346.0
GASTROPUS STYLIFER	.0	.0	.0	.0	.0	.0	.0
CONOCHILOIDES	181.0	.0	278.0	.0	202.0	.0	802.0
DOSSUMARIUS							
HEXARTHRA MIRA	.0	.0	93.0	56.0	.0	463.0	31.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0	.0	.0	.0
DIAPHANOSOMA	.0	.0	.0	.0	25.0	.0	.0
LEUCKTENBERGIANUM	0	69.0	.0	22.0	25.0	649.0	144.0
HOLOPEDIUM GIBBERUM	154.0	78.0	23.0	.0	25.0	649.0	494.0
DAPHNIA SPP	.0	14.0	46.0	111.0	51.0	278.0	62.0
DAPHNIA LONGIREMIS	157.0	.0	.0	.0	38.0	93.0	82.0
DAPHNIA RETROCURVA	338.0	.0	.0	22.0	25.0	.0	.0
DAPHNIA GALEATA MENDOTAE	2874.0	111.0	324.0	67.0	568.0	1759.0	761.0
DAPHNIA PARVULA	.0	.0	.0	22.0	.0	.0	.0
DAPHNIA PULEX	.0	.0	.0	.0	.0	.0	.0
DAPHNIA AMBIGUA	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	.0	.0	.0	133.0	38.0	185.0	82.0
BOSMINA LONGIROSTRIS	262.0	153.0	972.0	1867.0	316.0	2685.0	535.0
EUBOSMINA COREGONI	.0	.0	.0	.0	.0	.0	.0
CHYDORUS SPHAERICUS	209.0	14.0	.0	.0	38.0	185.0	41.0
DIAPTOMUS OREGONENSIS	2404.0	348.0	394.0	244.0	252.0	1574.0	133.0
DIAPTOMUS MINUTUS	419.0	42.0	255.0	67.0	51.0	185.0	62.0
DIAPTOMUS SICILIS	.0	.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	.0	111.0	1942.0	756.0	543.0	2778.0	494.0
CALANOIDA COPEPODITE STAGES	1745.0	28.0	93.0	222.0	114.0	278.0	123.0
CYCLOPS BICUSPIDATUS THOMASI	1528.0	264.0	278.0	689.0	746.0	1852.0	412.0
MESOCYCLOPS EDAX	237.0	14.0	46.0	89.0	51.0	185.0	123.0
CYCLOPOIDA NAUPLIAR STAGES	1486.0	389.0	1319.0	844.0	745.0	4074.0	802.0
CYCLOPOIDA COPEPODITE STAGES	1364.0	236.0	324.0	1022.0	429.0	1667.0	988.0
TOTALS FOR ALL SPECIES	42485.0	4739.0	38383.0	26789.0	15446.0	68151.0	14638.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	SEPT 23 1981 MARMION LAKE -SOUTH	OCT. 23 1981 ABIE LAKE	OCT. 23 1981 MARMION LAKE -ANDERSON DAM	OCT. 23 1981 MARMION LAKE -LOWER SEINE BAY	OCT. 23 1981 MARMION LAKE -SOUTH	OCT. 24 1981 MARMION LAKE -CENTRAL	OCT. 24 1981 MARMION LAKE -NORTH
BRACHIONUS SPP	.0	.0	.0	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA COCHLEARIS	1729.0	47777.0	126389.0	7068.0	7814.0	33778.0	660.0
KERATELLA QUADRATA	.0	.0	.0	.0	.0	.0	.0
KERATELLA HIEMALIS	.0	.0	.0	.0	.0	.0	.0
KERATELLA EARLINAE	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0	.0	.0	.0
NOTHOLCA ACUMINATA	.0	.0	.0	.0	.0	.0	.0
KELLICOTTIA LONGISPINA	123.0	5555.0	3334.0	525.0	833.0	2666.0	.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0	.0	.0	.0
LECANE SPP	31.0	.0	.0	.0	.0	.0	.0
LECANE LUNARIS	.0	.0	.0	93.0	.0	.0	.0
LECANE LUNA	.0	.0	.0	.0	69.0	.0	.0
LECANE BULA	.0	.0	.0	93.0	208.0	222.0	.0
TRICHOCERCA SPP	.0	.0	556.0	.0	.0	.0	.0
TRICHOCERCA CYLINDRICA	.0	.0	.0	62.0	.0	.0	.0
TRICHOCERCA MULTICRINIS	31.0	.0	556.0	.0	.0	.0	.0
TRICHOCERCA PORCELLUS	77.0	222.0	3333.0	62.0	486.0	3556.0	35.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	.0	.0	.0	69.0	.0	.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0	.0	.0	.0
ASPLANCHNA SPP	1050.0	1333.0	3056.0	217.0	625.0	4222.0	104.0
ASPLANCHNA PRIODONTA	.0	2222.0	1667.0	3179.0	7292.0	2889.0	417.0
POLYARTHRA SPP	756.0	12444.0	39722.0	1636.0	3125.0	18000.0	278.0
POLYARTHRA MINOR	.0	.0	.0	.0	.0	.0	.0
SYNCHAETA SPP	154.0	.0	833.0	154.0	347.0	.0	35.0
PLOESOMA SPP	.0	.0	.0	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	.0	.0	.0	.0	.0	.0	.0
PILINIA TERMINALIS	.0	.0	.0	.0	69.0	222.0	.0
PILINIA LONGISETA	.0	111.0	.0	.0	.0	.0	.0
CONOCHILUS UNICORNIS	432.0	.0	278.0	247.0	347.0	444.0	35.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	.0	.0	.0	.0
GASTROPUS SPP	1127.0	14000.0	13056.0	2068.0	2708.0	14444.0	347.0
GASTROPUS STYLIFER	.0	.0	.0	.0	.0	.0	.0
CONOCHILOIDES DOSSUARIUS	370.0	444.0	1667.0	185.0	138.0	.0	.0
HEXARTHRA MIRA	15.0	.0	.0	.0	.0	.0	.0
POMPHOLYX SPP	.0	.0	.0	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	.0	.0	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0	.0	.0	660.0
DIAPHANOSOMA LEUCHTENBERGIANUM	31.0	.0	.0	.0	.0	.0	35.0
HOLOPEDIUM GIBBERUM	138.0	222.0	.0	62.0	35.0	222.0	35.0
DAPHNIA SPP	46.0	111.0	556.0	.0	.0	.0	35.0
DAPHNIA LONGIREMIS	46.0	111.0	.0	.0	278.0	444.0	.0
DAPHNIA RETROCURVA	.0	.0	.0	.0	.0	444.0	.0
DAPHNIA GALEATA MENDOTAE	555.0	2555.0	3334.0	2099.0	2326.0	3111.0	208.0
DAPHNIA PARVULA	.0	.0	.0	62.0	.0	.0	.0
DAPHNIA PULEX	15.0	.0	.0	.0	.0	.0	.0
DAPHNIA AMBIGUA	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	.0	.0	.0	.0	.0
CERIODAPHNIA LACUSTRIS	.0	.0	833.0	62.0	.0	444.0	.0
BOSMINA LONGIROSTRIS	108.0	5778.0	30000.0	864.0	660.0	8222.0	278.0
EUBOSMINA COREGONI	.0	.0	.0	.0	.0	.0	.0
CHYDORUS SPHAERICUS	.0	.0	.0	185.0	69.0	.0	35.0
DIAPTOMUS OREGONENSIS	309.0	1333.0	1667.0	679.0	868.0	2000.0	104.0
DIAPTOMUS MINUTUS	77.0	1000.0	2778.0	432.0	313.0	2222.0	.0
DIAPTOMUS SICILIS	.0	.0	.0	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	525.0	4667.0	5556.0	1481.0	1042.0	7111.0	139.0
CALANOIDA COPEPODITE STAGES	139.0	1444.0	5000.0	432.0	938.0	3778.0	70.0
CYCLOPS BICUSPIDATUS THOMASI	433.0	2555.0	7777.0	988.0	1180.0	4667.0	243.0
MESOCYCLOPS EDAX	93.0	444.0	1667.0	247.0	556.0	1333.0	139.0
CYCLOPOIDA NAUPLIAR STAGES	602.0	6889.0	7778.0	2160.0	1667.0	9778.0	382.0
CYCLOPOIDA COPEPODITE STAGES	463.0	8444.0	25833.0	3086.0	3368.0	17111.0	625.0
TOTALS FOR ALL SPECIES	9475.0	119661.0	287226.0	28428.0	36630.0	141330.0	4899.0

APPENDIX

SPECIES COMPOSITION OF ZOOPLANKTON SAMPLES COLLECTED

USING SHINDLER PATALAS TRAP IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**3)

	NOV. 2 1981 ICY LAKE	NOV. 2 1981 MOOSE LAKE	NOV. 2 1981 SNOW LAKE	NOV. 2 1981 SLUSH LAKE
BRACHIONUS SPP	.0	.0	.0	.0
BRACHIONUS ANGULARIS	.0	.0	.0	.0
KERATELLA COCHLEARIS	116112.0	17885.0	91886.0	1518.0
KERATELLA QUADRATA	139.0	362.0	.0	.0
KERATELLA HIEMALIS	694.0	195.0	.0	271.0
KERATELLA EARLINAE	.0	.0	.0	.0
NOTHOLCA SPP	.0	.0	.0	.0
NOLTHOLCA ACUMINATA	139.0	.0	.0	.0
KELLICOTTIA LONGISPINA	3750.0	12833.0	5278.0	981.0
KELLICOTTIA BOSTONIENSIS	.0	.0	.0	.0
LEDADELLA SPP	.0	.0	.0	.0
LECANE SPP	.0	.0	.0	.0
LECANE LUNARIS	139.0	.0	.0	.0
LECANE LUNA	.0	.0	.0	.0
LECANE BULA	.0	.0	.0	.0
TRICHOCERCA SPP	.0	.0	.0	.0
TRICHOCERCA CYLINDRICA	.0	.0	.0	.0
TRICHOCERCA MULTICRINIS	.0	.0	.0	.0
TRICHOCERCA PORCELLUS	.0	.0	139.0	.0
TRICHOCERCA PUSILLA	.0	.0	.0	.0
TRICHOCERCA LONGISETA	.0	.0	278.0	.0
TRICHOCERCA ELONGATA	.0	.0	.0	.0
ASPLANCHNA SPP	2500.0	444.0	1250.0	86.0
ASPLANCHNA PRIODONTA	.0	500.0	278.0	.0
POLYARTHRA SPP	7500.0	2223.0	21945.0	271.0
POLYARTHRA MINOR	.0	.0	.0	.0
SYNCHAETA SPP	833.0	.0	139.0	.0
PLOESOMA SPP	.0	.0	.0	.0
PLOESOMA TRIACANTHUM	.0	.0	.0	.0
FILINIA TERMINALIS	.0	.0	.0	.0
FILINIA LONGISETA	417.0	278.0	.0	12.0
CONOCHILUS UNICORNIS	.0	.0	.0	.0
CONOCHILUS HIPPOCREPIS	.0	.0	.0	.0
EPIPHANES SPP	.0	.0	.0	.0
ASCOMORPHA SPP	.0	.0	.0	.0
GASTROPUS SPP	5111.0	2250.0	7917.0	198.0
GASTROPUS STYLIFER	.0	.0	.0	.0
CONOCHILOIDES	.0	.0	.0	.0
MOSSUMARIUS				
HEXARTHRA MIRA	.0	.0	.0	.0
POMPHOLYX SPP	.0	.0	.0	.0
COLLOTHECA PELAGICA	.0	.0	.0	.0
UNIDENTIFIED ROTIFER	.0	.0	.0	.0
DIAPHANOSOMA	139.0	28.0	0	.0
LEUCHTENBERGIANUM				
HOLOPEDIUM GIBBERUM	.0	.0	278.0	.0
DAPHNIA SPP	.0	83.0	.0	.0
DAPHNIA LONGIREMIS	278.0	417.0	.0	21.0
DAPHNIA RETROCURVA	.0	140.0	139.0	.0
DAPHNIA GALEATA MENDOTAE	556.0	2056.0	.0	41.0
DAPHNIA PARVULA	.0	.0	.0	.0
DAPHNIA PULEX	.0	.0	.0	.0
DAPHNIA AMBIGUA	.0	.0	.0	.0
CERIODAPHNIA SPP	.0	.0	417.0	.0
CERIODAPHNIA LACUSTRIS	.0	0	139.0	.0
BOSMINA LONGIROSTRIS	10834.0	334.0	10695.0	103.0
EUBOSMINA COREGONI	.0	.0	.0	.0
CHYDORUS SPHAERICUS	.0	28.0	139.0	.0
DIAPTOMUS OREGONENSIS	833.0	2833.0	2917.0	370.0
DIAPTOMUS MINUTUS	556.0	583.0	1111.0	144.0
DIAPTOMUS SICILIS	.0	.0	.0	.0
CALANOIDA NAUPLIAR STAGES	972.0	1500.0	2083.0	556.0
CALANOIDA COPEPODITE STAGES	1111.0	666.0	1806.0	206.0
CYCLOPS BICUSPIDATUS THOMASI	8056.0	1139.0	3472.0	1370.0
MESOCYCLOPS EDAX	694.0	167.0	417.0	62.0
CYCLOPOIDA NAUPLIAR STAGES	2083.0	2695.0	3194.0	885.0
CYCLOPOIDA COPEPODITE STAGES	7778.0	3305.0	8750.0	1255.0
TOTALS FOR ALL SPECIES	172224.0	52864.0	164587.0	7970.0

APPENDIX 8

Species Composition of Benthic Samples Collected Near Atikokan August and October 1981 and February 1982

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APPENDIX 9

SPECIES COMPOSITION OF LARVAL FISH SAMPLES COLLECTED

USING 0.5 METRE DAY TOW — IN THE VICINITY OF ATIKOKAN — JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**M)

	MAY 11 1981 FOTHERINGHAM LAKE	MAY 11 1981 FOTHERINGHAM LAKE	MAY 11 1981 SNOW LAKE	MAY 11 1981 SNOW LAKE	MAY 12 1981 ABIE LAKE	MAY 12 1981 ABIE LAKE	MAY 12 1981 ABIE LAKE-OUTLET
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.000	.000	.000	.000	.000	.000	.140
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.000	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.000	.000	.000	.000	.000	.140

	MAY 12 1981 ABIE LAKE-OUTLET	MAY 12 1981 MARMION LAKE -ANDERSON DAM	MAY 12 1981 MARMION LAKE -ANDERSON DAM	MAY 12 1981 ICY LAKE	MAY 12 1981 ICY LAKE	MAY 12 1981 MARMION LAKE -SOUTH	MAY 12 1981 MARMION LAKE -SOUTH
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.070	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.070	.000	.000	.000	.000	.003	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.000	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.070	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.140	.000	.070	.000	.000	.000	.000

	MAY 13 1981 ICY LAKE-OUTLET	MAY 13 1981 ICY LAKE-OUTLET	MAY 13 1981 MARMION LAKE -LOWER SEINE BAY	MAY 13 1981 MARMION LAKE -LOWER SEINE BAY	MAY 13 1981 MARMION LAKE -CENTRAL	MAY 13 1981 MARMION LAKE -CENTRAL	MAY 13 1981 MARMION LAKE -NORTH
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.000	.000	.000	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.000	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.000	.000	.000	.000	.000	.000

	MAY 13 1981 MARMION LAKE -NORTH	MAY 13 1981 MARMION LAKE -NORTH- WEST OUTLET	MAY 13 1981 MARMION LAKE -NORTH- WEST OUTLET	MAY 20 1981 MARMION LAKE -ANDERSON DAM	MAY 26 1981 MARMION LAKE -ANDERSON DAM	MAY 20 1981 ICY LAKE-OUTLET	MAY 20 1981 ICY LAKE-OUTLET
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.000	.000	.000	.140	.210	.210	.350
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.070
DARTER, IOWA	.000	.000	.000	.000	.000	.280	.070
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.000	.000	.140	.210	.490	.490

APPENDIX

SPECIES COMPOSITION OF LARVAL FISH SAMPLES COLLECTED

USING 0.5 METRE DAY TOW IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M*M*M)

	MAY 20 1981 MARMION LAKE -LOWER SEINE BAY	MAY 20 1981 MARMION LAKE -LOWER SEINE BAY	MAY 20 1981 MARMION LAKE -CENTRAL	MAY 20 1981 MARMION LAKE -CENTRAL	MAY 20 1981 MARMION LAKE -NORTH	MAY 20 1981 MARMION LAKE -NORTH	MAY 20 1981 MARMION LAKE -NORTH- WEST OUTLET
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.140	.140	.000	.000	.070	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.070	.070	.000	.000	.000	.070	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.210	.210	.000	.000	.070	.070	.000

	MAY 20 1981 MARMION LAKE -NORTH- WEST OUTLET	MAY 20 1981 SNOW LAKE	MAY 20 1981 SNOW LAKE	MAY 21 1981 ICY LAKE	MAY 21 1981 ICY LAKE	MAY 21 1981 MARMION LAKE -SOUTH	MAY 21 1981 MARMION LAKE -SOUTH
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.070	.420	1.213	6.860	15.729	.070	.070
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.000	.140	.000	.070	.140
LOG PERCH	.000	.000	.000	.070	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.070	.420	1.210	7.070	15.720	.140	.210

	MAY 22 1981 FOTHERINGHAM LAKE	MAY 22 1981 FOTHERINGHAM LAKE	MAY 28 1981 ABIE LAKE	MAY 28 1981 ABIE LAKE	MAY 28 1981 ABIE LAKE- OUTLET	MAY 28 1981 ABIE LAKE- OUTLET	MAY 29 1981 MARMION LAKE -ANDERSON DAM
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.000	.000	2.000	3.140	.420	.710	2.210
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.350	.640	.000	.000	1.500	2.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.350	.640	2.000	3.140	1.920	2.710	2.210

	MAY 29 1981 MARMION LAKE -ANDERSON DAM	MAY 29 1981 MARMION LAKE -LOWER SEINE BAY	MAY 29 1981 MARMION LAKE -LOWER SEINE BAY	MAY 29 1981 MARMION LAKE -CENTRAL	MAY 29 1981 MARMION LAKE -CENTRAL	MAY 29 1981 MARMION LAKE -NORTH	MAY 29 1981 MARMION LAKE -NORTH
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	1.070	.140	.350	2.070	1.000	1.420	.710
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.140	.000	.000	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	1.210	.140	.350	2.070	1.000	1.420	.710

APPENDIX

SPECIES COMPOSITION OF LARVAL FISH SAMPLES COLLECTED

USING 0.5 METRE DAY TOW IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./MMMM)

	MAY 29 1981 MARMION LAKE -NORTH- WEST OUTLET	MAY 29 1981 MARMION LAKE -NORTH- WEST OUTLET	JUNE 2 1981 ABIE LAKE	JUNE 2 1981 ABIE LAKE	JUNE 2 1981 ABIE LAKE-OUTLET	JUNE 2 1981 ABIE LAKE-OUTLET	JUNE 2 1981 FOTHERINGHAM LAKE
WHITE SUCKER	.000	.000	.110	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.210	.140	.400	.050	1.100	3.080	1.100
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.070	.000	.000	.290	.050	.000	.290
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.280	.140	.510	.340	1.150	3.080	1.390

	JUNE 2 1981 FOTHERINGHAM LAKE	JUNE 2 1981 ICY LAKE	JUNE 2 1981 ICY LAKE	JUNE 2 1981 ICY LAKE-OUTLET	JUNE 2 1981 ICY LAKE-OUTLET	JUNE 2 1981 MARMION LAKE -SOUTH	JUNE 2 1981 MARMION LAKE -SOUTH
WHITE SUCKER	.000	.000	.050	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	2.030	.400	.170	.930	1.920	.990	1.510
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.520	.000	.000	.000	.000	.290	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	2.550	.400	.220	.930	1.920	1.280	1.510

	JUNE 2 1981 SNOW LAKE	JUNE 2 1981 SNOW LAKE	JUNE 16 1981 ABIE LAKE	JUNE 16 1981 ABIE LAKE	JUNE 16 1981 ABIE LAKE-OUTLET	JUNE 16 1981 ABIE LAKE-OUTLET	JUNE 16 1981 FOTHERINGHAM LAKE
WHITE SUCKER	.000	.050	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.050	.110	.450	.110	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.000	.110	.050	.000	.000	.000	.050
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.400	1.040	1.330	2.150	.230
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.160	.500	1.150	1.730	2.260	.280

	JUNE 16 1981 FOTHERINGHAM LAKE	JUNE 16 1981 ICY LAKE	JUNE 16 1981 ICY LAKE	JUNE 16 1981 ICY LAKE-OUTLET	JUNE 16 1981 ICY LAKE-OUTLET	JUNE 16 1981 MARMION LAKE -LOWER SEINE BAY	JUNE 16 1981 MARMION LAKE -LOWER SEINE BAY
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.110	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.230	.000	.050	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.050
DARTER, IOWA	.110	.690	.050	.170	.690	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.340	.690	.100	.170	.800	.000	.050

APPENDIX

SPECIES COMPOSITION OF LARVAL FISH SAMPLES COLLECTED

USING 0.5 METRE DAY TOW IN THE VICINITY OF ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./MMMM)

	JUNE 16 1981 MARMION LAKE -SOUTH	JUNE 16 1981 MARMION LAKE -SOUTH	JUNE 16 1981 SNOW LAKE	JUNE 16 1981 SNOW LAKE	JUNE 18 1981 MARMION LAKE -ANDERSON DAM	JUNE 18 1981 MARMION LAKE -ANDERSON DAM	JUNE 18 1981 MARMION LAKE -CENTRAL
WHITE SUCKER	.000	.000	.000	.000	.230	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.050	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.110	.170	.000	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.230	.050	.050	.690	.110	.000	4.250
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.390	.220	.050	.690	.340	.000	4.250

	JUNE 18 1981 MARMION LAKE -CENTRAL	JUNE 18 1981 MARMION LAKE -NORTH	JUNE 18 1981 MARMION LAKE -NORTH	JUNE 18 1981 MARMION LAKE -NORTH- WEST OUTLET	JUNE 18 1981 MARMION LAKE -NORTH- WEST OUTLET	JULY 6 1981 ABIE LAKE	JULY 6 1981 ABIE LAKE
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.050
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.610	.000
YELLOW PERCH	.000	.000	.000	.000	.000	.050	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	1.000	.000	.000	.000	.110	.000	.050
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	1.000	.000	.000	.000	.110	.610	.100

	JULY 6 1981 ABIE LAKE- OUTLET	JULY 6 1981 ABIE LAKE- OUTLET	JULY 6 1981 MARMION LAKE -ANDERSON DAM	JULY 6 1981 MARMION LAKE -ANDERSON DAM	JULY 6 1981 FOTHERINGHAM LAKE	JULY 6 1981 FOTHERINGHAM LAKE	JULY 6 1981 ICY LAKE
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.050
YELLOW PERCH	.000	.000	.000	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.220	.050	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.220	.050	.000	.000	.000	.050

	JULY 6 1981 ICY LAKE	JULY 6 1981 ICY LAKE- OUTLET	JULY 6 1981 ICY LAKE- OUTLET	JULY 6 1981 MARMION LAKE -LOWER SEINE BAY	JULY 6 1981 MARMION LAKE -LOWER SEINE BAY	JULY 6 1981 MARMION LAKE -CENTRAL	JULY 6 1981 MARMION LAKE -CENTRAL
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.050	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.110	.110	.220	.000	.000	.000	.000
YELLOW PERCH	.000	.000	.000	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.220	.000	.110	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.330	.110	.330	.000	.050	.000	.000

APPENDIX

SPECIES COMPOSITION OF LARVAL FISH SAMPLES COLLECTED

USING 0.5 METRE DAY TOW — IN THE VICINITY OF ATIKOKAN — JAN. 1 1981 TO DEC. 31 1981

VALUES ARE EXPRESSED AS DENSITY (NO./M**M)

	JULY 6 1981 MARMION LAKE -NORTH	JULY 6 1981 MARMION LAKE -NORTH	JULY 6 1981 MARMION LAKE -NORTH- WEST OUTLET	JULY 6 1981 MARMION LAKE -NORTH- WEST OUTLET	JULY 6 1981 MARMION LAKE -SOUTH	JULY 6 1981 MARMION LAKE -SOUTH	JULY 6 1981 SNOW LAKE
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.050	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.000	.000	.000	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.050	.000	.110	.110	.000	.050	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.050
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.050	.000	.160	.110	.000	.050	000

	JULY 6 1981 SNOW LAKE	JULY 21 1981 MARMION LAKE -ANDERSON DAM	JULY 21 1981 MARMION LAKE -ANDERSON DAM	JULY 21 1981 MARMION LAKE -CENTRAL	JULY 21 1981 MARMION LAKE -CENTRAL	JULY 21 1981 MARMION LAKE -NORTH	JULY 21 1981 MARMION LAKE -NORTH
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.000
YELLOW PERCH	.000	.000	.000	.000	.000	.050	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.000	.050	.000	.050	.050
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.000	.000	.050	.000	.100	.050

	JULY 21 1981 MARMION LAKE -NORTH- WEST OUTLET	JULY 21 1981 MARMION LAKE -NORTH- WEST OUTLET	JULY 23 1981 ABIE LAKE	JULY 23 1981 ABIE LAKE	JULY 23 1981 ABIE LAKE- OUTLET	JULY 23 1981 ABIE LAKE- OUTLET	JULY 23 1981 -ICY LAKE
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.110	.000	.000	.560	.050
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000	.000	.000	.110
YELLOW PERCH	.000	.000	.000	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.050	.000	.000	.050	.000	.110
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.050	.110	.000	.050	.560	.270

	JULY 23 1981 ICY LAKE	JULY 23 1981 ICY LAKE- OUTLET	JULY 23 1981 ICY LAKE- OUTLET	JULY 23 1981 MARMION LAKE -SOUTH	JULY 23 1981 MARMION LAKE -SOUTH	JULY 24 1981 MARMION LAKE -LOWER SEINE BAY	JULY 24 1981 MARMION LAKE -LOWER SEINE BAY
WHITE SUCKER	.000	.000	.000	.000	.000	.000	.000
CYPRINIDAE	.000	.220	.110	.050	.050	.220	.000
BURBOT	.000	.000	.000	.000	.000	.000	.000
PUMPKINSEED	.110	.220	.000	.000	.000	.050	.000
YELLOW PERCH	.000	.000	.000	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.000	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.110	.440	.110	.050	.050	.270	.000

	JULY 29 1981 SNOW LAKE	JULY 29 1981 SNOW LAKE	JULY 29 1981 SLUSH LAKE	JULY 29 1981 SLUSH LAKE
WHITE SUCKER	.000	.000	.000	.000
CYPRINIDAE	.000	.000	.000	.000
BURBOT	.000	.000	.000	.000
PUMPKINSEED	.000	.000	.000	.000
YELLOW PERCH	.000	.000	.000	.000
YELLOW PICKEREL(WALLEYE	.000	.000	.000	.000
DARTER, IOWA	.000	.000	.000	.000
LOG PERCH	.000	.000	.000	.000
LAKE WHITEFISH	.000	.000	.000	.000
TOTALS FOR ALL SPECIES	.000	.000	.000	.000

APPENDIX 10

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	MAY 11 1981 FOTHERINGHAM LAKE BEACH SEINE ONE	MAY 11 1981 FOTHERINGHAM LAKE BEACH SEINE TWO	MAY 11 1981 FOTHERINGHAM LAKE BEACH SEINE THREE	MAY 11 1981 SNOW LAKE BEACH SEINE ONE	MAY 11 1981 SNOW LAKE BEACH SEINE TWO	MAY 11 1981 SNOW LAKE BEACH SEINE THREE	MAY 12 1981 ABIE LAKE BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	1	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	20	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	0	86	0	0
SHINER, SPOTTAIL	0	0	0	1	2	0	0
SHINER, MIMIC	0	0	0	2	34	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	1	0	56	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	1	6	1	1	1	1	9
LOG PERCH	0	0	0	0	3	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	1	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	7	1	71	147	1	12

	MAY 12 1981 ABIE LAKE BEACH SEINE TWO	MAY 12 1981 ABIE LAKE BEACH SEINE THREE	MAY 12 1981 ICY LAKE BEACH SEINE ONE	MAY 12 1981 ICY LAKE BEACH SEINE TWO	MAY 12 1981 ICY LAKE BEACH SEINE THREE	MAY 12 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	MAY 12 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	108	74	1	0	0
SHINER, SPOTTAIL	0	0	5	9	0	0	0
SHINER, MIMIC	0	0	63	121	11	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	4	21	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	27	80	0	0	2	4	0
LOG PERCH	0	2	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	27	82	181	225	14	4	0

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	MAY 13 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	MAY 13 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO	MAY 13 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE	MAY 13 1981 MARMION LAKE -NORTH BEACH SEINE ONE	MAY 13 1981 MARMION LAKE -NORTH BEACH SEINE TWO	MAY 13 1981 MARMION LAKE -NORTH BEACH SEINE THREE	MAY 20 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	0	0	0	0
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	1
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	1
DARTER, IOWA	0	1	0	1	1	0	0
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	1	0	1	1	0	2

	MAY 12 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE	MAY 12 1981 MARMION LAKE -SOUTH BEACH SEINE ONE	MAY 12 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	MAY 12 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	MAY 13 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE	MAY 13 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO	MAY 13 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	1	0	18	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	8	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	369	0	0	0	0	0	0
SHINER, SPOTTAIL	0	1	0	1	0	0	2
SHINER, MIMIC	0	8	0	0	0	0	1
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	1	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	862	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	4	0	0	0	0	0	2
LOG PERCH	0	0	0	0	0	0	5
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1226	23	3	2	0	18	27

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	MAY 20 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO	MAY 20 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE	MAY 20 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	MAY 20 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO	MAY 20 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE	MAY 20 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	MAY 20 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO
NORTHERN PIKE	2	0	0	0	0	0	0
WHITE SUCKER	0	0	0	2	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	2	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	85	0	6	0
SHINER, SPOTTAIL	0	0	0	0	0	1	0
SHINER, MIMIC	0	0	0	0	0	93	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	11	0	17	0	101	0
YELLOW PICKEREL(WALLEYE	0	5	0	0	0	0	0
DARTER, IOWA	0	0	0	0	1	0	0
LOG PERCH	0	54	0	2	0	2	0
SLIMY SCULPIN	0	0	0	1	0	0	0
LAKE WHITEFISH	0	0	1	0	0	0	5
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	2	65	1	109	1	203	5

	MAY 20 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE	MAY 20 1981 MARMION LAKE -NORTH BEACH SEINE ONE	MAY 20 1981 MARMION LAKE -NORTH BEACH SEINE TWO	MAY 20 1981 MARMION LAKE -NORTH BEACH SEINE THREE	MAY 21 1981 ABIE LAKE BEACH SEINE ONE	MAY 21 1981 ABIE LAKE BEACH SEINE TWO	MAY 21 1981 ABIE LAKE BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	1	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	4	0	0	0	0	6	74
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	297	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	1	0	0	0	0	132	23
LOG PERCH	2	2	0	0	0	2	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	28	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	332	2	0	0	0	141	97

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	MAY 21 1981 ICY LAKE BEACH SEINE ONE	MAY 21 1981 ICY LAKE BEACH SEINE TWO	MAY 21 1981 ICY LAKE BEACH SEINE THREE	MAY 21 1981 MARMION LAKE -SOUTH BEACH SEINE ONE	MAY 21 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	MAY 21 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	MAY 21 1981 SNOW LAKE BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	15	0	14	0	37	0	0
SHINER, GOLDEN	0	0	0	0	0	0	20
SHINER, EMERALD	0	0	0	0	1	0	0
SHINER, BLACKNOSE	230	225	1350	0	3	0	110
SHINER, SPOTTAIL	12	0	6	0	22	0	0
SHINER, MIMIC	10	0	4	3	18	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	125	2	48	0	574	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	1	0	5	1	0	20
LOG PERCH	0	0	0	0	27	1	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	25	1	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	392	228	1422	8	718	2	150

	MAY 21 1981 SNOW LAKE BEACH SEINE TWO	MAY 21 1981 SNOW LAKE BEACH SEINE THREE	MAY 22 1981 FOTHERINGHAM LAKE BEACH SEINE ONE	MAY 22 1981 FOTHERINGHAM LAKE BEACH SEINE TWO	MAY 22 1981 FOTHERINGHAM LAKE BEACH SEINE THREE	MAY 29 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE	MAY 29 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO
NORTHERN PIKE	0	0	2	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	74	54	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	280	240	0	0	0	0	0
SHINER, SPOTTAIL	0	0	0	0	0	0	1
SHINER, MIMIC	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	112	0	0
YELLOW PERCH	0	6	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	1	0	3	0
DARTER, IOWA	22	0	1	0	0	10	0
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	376	300	3	1	112	13	4

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	MAY 29 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE	MAY 29 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	MAY 29 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO	MAY 29 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE	MAY 29 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	MAY 29 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO	MAY 29 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	2	5	0	0	1	0
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	268	0	1	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	1	0	10
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	21	229	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	2	0	2	0	3	1	2
LOG PERCH	0	0	0	0	29	5	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	1	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	2	270	7	1	54	237	12

	MAY 29 1981 MARMION LAKE -NORTH BEACH SEINE ONE	MAY 29 1981 MARMION LAKE -NORTH BEACH SEINE TWO	MAY 29 1981 MARMION LAKE -NORTH BEACH SEINE THREE	MAY 29 1981 MARMION LAKE -SOUTH BEACH SEINE ONE	MAY 29 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	MAY 29 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	JUNE 2 1981 ABIE LAKE BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	4
SHINER, BLACKNOSE	0	0	0	0	0	0	0
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	2	9	15	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	21	229	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	1	0	18
DARTER, IOWA	0	0	0	0	0	0	0
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	23	238	15	0	1	0	22

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	JUNE 2 1981 ABIE LAKE BEACH SEINE TWO	JUNE 2 1981 ABIE LAKE BEACH SEINE THREE	JUNE 2 1981 FOTHERINGHAM LAKE BEACH SEINE ONE	JUNE 2 1981 FOTHERINGHAM LAKE BEACH SEINE TWO	JUNE 2 1981 FOTHERINGHAM LAKE BEACH SEINE THREE	JUNE 2 1981 ICY LAKE BEACH SEINE ONE	JUNE 2 1981 ICY LAKE BEACH SEINE TWO
NORTHERN PIKE	2	1	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	349	68
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	18	96	2	4	432	0	1372
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	8	1	0	1	1	12	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	17	28	0	1	0	0	0
LOG PERCH	3	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	48	126	2	6	433	352	1432

	JUNE 2 1981 ICY LAKE BEACH SEINE THREE	JUNE 2 1981 SNOW LAKE BEACH SEINE ONE	JUNE 2 1981 SNOW LAKE BEACH SEINE TWO	JUNE 2 1981 SNOW LAKE BEACH SEINE THREE	JUNE 16 1981 ABIE LAKE BEACH SEINE ONE	JUNE 16 1981 ABIE LAKE BEACH SEINE TWO	JUNE 16 1981 ABIE LAKE BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	4	1	2
WHITE SUCKER	0	0	0	0	1	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	1	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	3	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	3
SHINER, EMERALD	0	0	0	0	0	0	3
SHINER, BLACKNOSE	17	0	0	3	127	21	24
SHINER, SPOTTAIL	0	0	0	0	9	0	2
SHINER, MIMIC	0	0	0	0	4	1	0
BLUNTNOSE MINNOW	0	0	0	3	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	3	0	0
PUMPKINSEED	0	0	0	0	0	0	1
YELLOW PERCH	3	0	0	0	45	3	9
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	0	19	15	6	1	4
LOG PERCH	0	0	0	0	17	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	20	0	19	18	214	24	42

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	JUNE 16 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE	JUNE 16 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO	JUNE 16 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE	JUNE 16 1981 FOTHERINGHAM LAKE BEACH SEINE ONE	JUNE 16 1981 FOTHERINGHAM LAKE BEACH SEINE TWO	JUNE 16 1981 FOTHERINGHAM LAKE BEACH SEINE THREE	JUNE 16 1981 ICY LAKE BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	6	0	0	0	1	2	2
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	30
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	0	0	0	352
SHINER, SPOTTAIL	0	1	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	0	0	126
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	2	1	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	405	0	0	0	247	556	40
YELLOW PICKEREL(WALLEYE	12	0	0	0	0	0	0
DARTER, IOWA	0	0	0	0	2	6	0
LOG PERCH	1	1	5	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	424	4	6	0	250	564	550

	JUNE 16 1981 ICY LAKE BEACH SEINE TWO	JUNE 16 1981 ICY LAKE BEACH SEINE THREE	JUNE 16 1981 MARMION LAKE -SOUTH BEACH SEINE ONE	JUNE 16 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	JUNE 16 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	JUNE 16 1981 SNOW LAKE BEACH SEINE ONE	JUNE 16 1981 SNOW LAKE BEACH SEINE TWO
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	729	1824	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	2	6	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	332	66	0	1	5	4	30
SHINER, SPOTTAIL	5	3	0	0	2	0	0
SHINER, MIMIC	70	12	2	3	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	4	18	45	217	199	11	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	4	0	0	0	0	0	9
LOG PERCH	0	0	0	1	3	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1140	1929	47	222	209	15	39

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	JUNE 16 1981 SNOW LAKE BEACH SEINE THREE	JUNE 18 1981 MARMION LAKE -NORTH BEACH SEINE ONE	JUNE 18 1981 MARMION LAKE -NORTH BEACH SEINE TWO	JUNE 18 1981 MARMION LAKE -NORTH BEACH SEINE THREE	JUNE 19 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	JUNE 19 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO	JUNE 19 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	1	0	0
WHITE SUCKER	0	18	1	1	4	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	1	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	0	70	45	12
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	4	49	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	2	0	45	8	280	24
YELLOW PICKEREL(WALLEYE	0	1	0	0	0	0	0
DARTER, IOWA	1	0	0	0	9	0	2
LOG PERCH	0	0	0	0	5	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	21	1	46	102	374	38

	JUNE 19 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	JUNE 19 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO	JUNE 19 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE	JULY 13 1981 MOOSE LAKE BEACH SEINE ONE	JULY 13 1981 MOOSE LAKE BEACH SEINE TWO	JULY 21 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE	JULY 21 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO
NORTHERN PIKE	0	0	1	0	0	0	0
WHITE SUCKER	5	0	6	14	0	26	13
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	2	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	12	27	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	1	19	23	50	27
SHINER, SPOTTAIL	0	0	0	0	0	2	0
SHINER, MIMIC	1	1	0	0	0	848	276
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	91	844	9	58	35	6	13
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	0	2	0	1	0	1
LOG PERCH	0	0	0	0	0	56	39
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	97	845	19	103	86	990	369

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	JULY 21 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE	JULY 21 1981 MARMION LAKE -NORTH BEACH SEINE ONE	JULY 21 1981 MARMION LAKE -NORTH BEACH SEINE TWO	JULY 21 1981 MARMION LAKE -NORTH BEACH SEINE THREE	JULY 22 1981 ICY LAKE BEACH SEINE ONE	JULY 22 1981 ICY LAKE BEACH SEINE TWO	JULY 22 1981 ICY LAKE BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	24	2	2	0	10	2	1
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	106	3
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	410	0	1	0	55	22	4
SHINER, SPOTTAIL	0	0	0	0	16	6	23
SHINER, MIMIC	630	1	0	0	3	131	5
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	8	0	3
YELLOW PERCH	220	43	245	4	160	106	2
YELLOW PICKEREL(WALLEYE	0	1	4	0	12	1	0
DARTER, IOWA	2	0	0	0	0	0	0
LOG PERCH	20	8	14	11	0	0	5
SLIMY SCULPIN	0	0	1	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	1	0	0	0	0
TOTALS FOR ALL SPECIES	1306	55	268	15	264	374	46

	JULY 23 1981 ABIE LAKE BEACH SEINE ONE	JULY 23 1981 ABIE LAKE BEACH SEINE TWO	JULY 23 1981 ABIE LAKE BEACH SEINE THREE	JULY 23 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	JULY 23 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO	JULY 23 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE	JULY 23 1981 MARMION LAKE -SOUTH BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	2	0	3
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	1	8	109	0	0	0	0
SHINER, GOLDEN	0	2	1	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	8	323	17	3	0	0	14
SHINER, SPOTTAIL	0	5	2	0	0	0	3
SHINER, MIMIC	0	13	0	0	0	0	106
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	19	166	4	3	11	3	54
YELLOW PICKEREL(WALLEYE	0	0	3	0	0	0	0
DARTER, IOWA	2	4	0	2	1	0	0
LOG PERCH	0	3	0	0	0	0	6
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	30	524	133	8	14	3	188

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	JULY 23 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	JULY 23 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	JULY 24 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	JULY 24 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO	JULY 24 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE	JULY 29 1981 SNOW LAKE BEACH SEINE ONE	JULY 29 1981 SNOW LAKE BEACH SEINE TWO
NORTHERN PIKE	0	0	0	0	0	0	1
WHITE SUCKER	1	8	2	2	0	1	17
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	3	1	0	0	0	0	0
SHINER, GOLDEN	0	1	0	0	2	11	25
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	5	4	9	0	15	12	345
SHINER, SPOTTAIL	2	1	0	0	2	0	0
SHINER, MIMIC	1	177	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	5
YELLOW PERCH	110	126	15	5	54	6	264
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	0	1	0	1	2	8
LOG PERCH	2	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	124	318	27	7	74	32	665

	JULY 29 1981 SNOW LAKE BEACH SEINE THREE	JULY 29 1981 SLUSH LAKE BEACH SEINE ONE	JULY 29 1981 SLUSH LAKE BEACH SEINE TWO	JULY 29 1981 SLUSH LAKE BEACH SEINE THREE	AUG. 18 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	AUG. 18 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO	AUG. 18 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	4	56
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	0	2	3	48
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	0	1	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	62	0	0
YELLOW PERCH	11	0	3	0	7	3	27
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	1	0	0	0	0	0	0
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	12	0	3	0	71	11	131

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	AUG. 18 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	AUG. 18 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO	AUG. 18 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE	AUG. 18 1981 MARMION LAKE -NORTH BEACH SEINE ONE	AUG. 18 1981 MARMION LAKE -NORTH BEACH SEINE TWO	AUG. 18 1981 MARMION LAKE -NORTH BEACH SEINE THREE	AUG. 18 1981 MARMION LAKE -SOUTH BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	2	26
SHINER, GOLDEN	0	1	0	0	0	0	2
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	2	0	0	0	2	28
SHINER, SPOTTAIL	0	0	0	17	2	12	0
SHINER, MIMIC	0	44	2	28	0	16	64
BLUNTNOSE MINNOW	0	0	0	1	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	3	0	0	0	0	1	0
YELLOW PERCH	3	2	0	0	1	2	266
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	1	1	0	0	0	0	0
LOG PERCH	0	1	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	7	51	2	46	3	35	378

	AUG. 18 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	AUG. 18 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	AUG. 20 1981 ABIE LAKE BEACH SEINE ONE	AUG. 20 1981 ABIE LAKE BEACH SEINE TWO	AUG. 20 1981 ABIE LAKE BEACH SEINE THREE	AUG. 20 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE	AUG. 20 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	13	11
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	41	17	0	0	0
SHINER, GOLDEN	6	0	0	0	0	0	0
SHINER, EMERALD	0	0	1	1	0	0	0
SHINER, BLACKNOSE	2	0	6	10	5	1	2
SHINER, SPOTTAIL	2	0	13	2	0	10	30
SHINER, MIMIC	22	0	8	0	0	87	184
BLUNTNOSE MINNOW	0	0	0	0	0	0	4
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	19	104	5	0	0
YELLOW PERCH	70	2	33	22	3	2	3
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	0	0	0	0	0	0
LOG PERCH	0	0	0	0	0	4	14
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	102	2	121	156	18	117	253

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	AUG. 20 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE	AUG. 20 1981 MOOSE LAKE BEACH SEINE ONE	AUG. 20 1981 MOOSE LAKE BEACH SEINE TWO	AUG. 20 1981 MOOSE LAKE BEACH SEINE THREE	AUG. 20 1981 SNOW LAKE BEACH SEINE ONE	AUG. 20 1981 SNOW LAKE BEACH SEINE TWO	AUG. 20 1981 SNOW LAKE BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	1	0	0	0	3	18	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	1	8	1	732	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	1	57	26	29	110
SHINER, SPOTTAIL	7	0	0	0	0	0	0
SHINER, MIMIC	360	27	342	876	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	3	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	9	41	0
YELLOW PERCH	0	0	2	24	0	140	3
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	3	0	6	2	18	4
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	368	30	344	971	41	998	117

	AUG. 21 1981 ICY LAKE BEACH SEINE ONE	AUG. 21 1981 ICY LAKE BEACH SEINE TWO	AUG. 21 1981 ICY LAKE BEACH SEINE THREE	AUG. 21 1981 SLUSH LAKE BEACH SEINE ONE	AUG. 21 1981 SLUSH LAKE BEACH SEINE TWO	AUG. 21 1981 SLUSH LAKE BEACH SEINE THREE	SEPT. 15 1981 SLUSH LAKE BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	3	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	7	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	2	0	60	0	0
SHINER, SPOTTAIL	183	0	0	0	0	0	0
SHINER, MIMIC	2	1	75	0	0	0	0
BLUNTNOSE MINNOW	724	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	4	0	0	0	0
YELLOW PERCH	2	6	22	28	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	1	0	0	0	0	0
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	918	8	103	28	60	0	0

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	SEPT 15 1981 SLUSH LAKE BEACH SEINE TWO	SEPT 15 1981 SLUSH LAKE BEACH SEINE THREE	SEPT 17 1981 ICY LAKE BEACH SEINE ONE	SEPT 17 1981 ICY LAKE BEACH SEINE TWO	SEPT 17 1981 ICY LAKE BEACH SEINE THREE	SEPT 17 1981 SNOW LAKE BEACH SEINE ONE	SEPT 17 1981 SNOW LAKE BEACH SEINE TWO
NORTHERN PIKE	0	0	1	0	0	0	0
WHITE SUCKER	0	0	0	0	1	0	24
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	48	0	0	16
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	198	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	1	10
YELLOW PERCH	1	1	41	0	0	8	32
YELLOW PICKEREL(WALLEYE	0	0	0	0	1	0	0
DARTER, IOWA	0	0	0	8	0	0	24
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	1	0	1	0	1
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	1	43	56	201	9	189

	SEPT 17 1981 SNOW LAKE BEACH SEINE THREE	SEPT 18 1981 ABIE LAKE BEACH SEINE ONE	SEPT 18 1981 ABIE LAKE BEACH SEINE TWO	SEPT 18 1981 ABIE LAKE BEACH SEINE THREE	SEPT 18 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	SEPT 18 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO	SEPT 18 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	1	0	16
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	31	65	11	0	2	23
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	1
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	4	1	0	5	0	0	70
YELLOW PERCH	0	0	0	0	21	5	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	2	0	0	2	1	0	0
LOG PERCH	0	0	0	0	0	1	0
SLIMY SCULPIN	1	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	7	32	68	18	23	19	119

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	SEPT 18 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	SEPT 18 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO	SEPT 18 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE	SEPT 18 1981 MOOSE LAKE BEACH SEINE ONE	SEPT 18 1981 MOOSE LAKE BEACH SEINE TWO	SEPT 18 1981 MOOSE LAKE BEACH SEINE THREE	SEPT 18 1981 MARMION LAKE -NORTH BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	1	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	5	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	598	1	0	1	0	24	0
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	335	0	0	0	1	7	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	2
YELLOW PERCH	0	0	0	9	1	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	1	0	3	2	3	7	1
LOG PERCH	1	0	0	0	0	0	0
SLIMY SCULPIN	1	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	933	2	3	12	5	38	3

	SEPT 18 1981 MARMION LAKE -NORTH BEACH SEINE TWO	SEPT 18 1981 MARMION LAKE -NORTH BEACH SEINE THREE	SEPT 18 1981 MARMION LAKE -SOUTH BEACH SEINE ONE	SEPT 18 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	SEPT 18 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	SEPT 21 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE	SEPT 21 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	6	0	0	3
REDBELLY DACE	0	0	0	3	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	1	0	0	0	0	0
SHINER, SPOTTAIL	0	0	0	0	0	2	4
SHINER, MIMIC	0	0	0	0	0	0	42
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	1	0	0	0	0	0	3
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	1	0	1	1	2
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	0	0	0	1	0	0
LOG PERCH	0	0	0	1	3	0	1
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	1	1	7	5	3	47

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	SEPT 21 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE	OCT. 13 1981 ICY LAKE BEACH SEINE ONE	OCT. 13 1981 ICY LAKE BEACH SEINE TWO	OCT. 13 1981 ICY LAKE BEACH SEINE THREE	OCT. 13 1981 SNOW LAKE BEACH SEINE ONE	OCT. 13 1981 SNOW LAKE BEACH SEINE TWO	OCT. 13 1981 SNOW LAKE BEACH SEINE THREE
NORTHERN PIKE	0	0	1	0	0	0	0
WHITE SUCKER	0	0	0	0	0	1	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	0	0	0	0	0
SHINER, SPOTTAIL	4	0	0	0	0	0	0
SHINER, MIMIC	2	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	5	32	0	0	2	1	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	0	0	0	1	0	0
LOG PERCH	16	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	1	1	1
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	27	32	1	0	4	3	1

	OCT. 14 1981 SLUSH LAKE BEACH SEINE ONE	OCT. 14 1981 SLUSH LAKE BEACH SEINE TWO	OCT. 14 1981 SLUSH LAKE BEACH SEINE THREE	OCT. 19 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE ONE	OCT. 19 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE TWO	OCT. 19 1981 MARMION LAKE -ANDERSON DAM BEACH SEINE THREE	OCT. 20 1981 ABIE LAKE BEACH SEINE ONE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	1	2	0	0	0
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	0	0	1	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	1	1	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	1	3	5	7	0	1
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
DARTER, IOWA	0	0	0	0	0	0	1
LOG PERCH	0	0	0	0	0	0	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	1	4	8	9	0	2

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1981

NET NAMES: BEACH SEINE ONE TO BEACH SEINE THREE

	OCT. 20 1981 ABIE LAKE BEACH SEINE TWO	OCT. 20 1981 ABIE LAKE BEACH SEINE THREE	OCT. 20 1981 MOOSE LAKE BEACH SEINE ONE	OCT. 20 1981 MOOSE LAKE BEACH SEINE TWO	OCT. 20 1981 MOOSE LAKE BEACH SEINE THREE	OCT. 20 1981 MARMION LAKE -NORTH BEACH SEINE ONE	OCT. 20 1981 MARMION LAKE -NORTH BEACH SEINE TWO
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	0	0	0
SHINER, GOLDEN	0	0	0	0	0	2	0
SHINER, EMERALD	0	0	0	0	0	0	0
SHINER, BLACKNOSE	0	0	25	0	0	0	0
SHINER, SPOTTAIL	0	0	0	0	0	0	0
SHINER, MIMIC	0	0	2	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	1
DARTER, IOWA	1	0	5	5	3	0	0
LOG PERCH	0	0	0	0	0	3	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	0	32	5	3	3	1

	OCT. 20 1981 MARMION LAKE -NORTH BEACH SEINE THREE	OCT. 20 1981 MARMION LAKE -SOUTH BEACH SEINE ONE	OCT. 20 1981 MARMION LAKE -SOUTH BEACH SEINE TWO	OCT. 20 1981 MARMION LAKE -SOUTH BEACH SEINE THREE	OCT. 21 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE ONE	OCT. 21 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE TWO	OCT. 21 1981 MARMION LAKE -LOWER SEINE BAY BEACH SEINE THREE
NORTHERN PIKE	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
CYPRINIDAE	0	0	0	0	0	0	0
REDBELLY DACE	0	0	0	0	0	0	0
FINESCALE DACE	0	0	0	0	0	0	0
LAKE CHUB	0	0	0	0	2	0	0
SHINER, GOLDEN	0	0	0	0	0	0	0
SHINER, EMERALD	0	0	0	0	2	0	0
SHINER, BLACKNOSE	0	0	0	0	0	0	0
SHINER, SPOTTAIL	0	0	0	0	5	0	40
SHINER, MIMIC	0	0	0	0	0	0	0
BLUNTNOSE MINNOW	0	0	0	0	0	0	0
FATHEAD MINNOW	0	0	0	0	0	0	0
BURBOT	0	0	0	0	1	0	0
STICKLEBACK, NINESPINE	0	0	0	0	0	0	0
TROUT-PERCH	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	161	0	1
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	2
DARTER, IOWA	0	1	0	0	0	0	0
LOG PERCH	0	0	0	0	1	1	0
SLIMY SCULPIN	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	1	0	0	172	1	43

	OCT. 24 1981 MARMION LAKE -CENTRAL BEACH SEINE ONE	OCT. 24 1981 MARMION LAKE -CENTRAL BEACH SEINE TWO	OCT. 24 1981 MARMION LAKE -CENTRAL BEACH SEINE THREE
NORTHERN PIKE	0	0	0
WHITE SUCKER	0	0	0
CYPRINIDAE	0	0	0
REDBELLY DACE	0	0	0
FINESCALE DACE	0	0	0
LAKE CHUB	0	0	0
SHINER, GOLDEN	0	0	0
SHINER, EMERALD	0	0	0
SHINER, BLACKNOSE	0	1	0
SHINER, SPOTTAIL	0	0	0
SHINER, MIMIC	1	0	0
BLUNTNOSE MINNOW	0	0	0
FATHEAD MINNOW	0	0	0
BURBOT	0	0	0
STICKLEBACK, NINESPINE	0	0	0
TROUT-PERCH	0	0	0
PUMPKINSEED	0	0	0
YELLOW PERCH	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0
DARTER, IOWA	0	0	0
LOG PERCH	0	0	0
SLIMY SCULPIN	0	0	0
LAKE WHITEFISH	0	0	0
CISCO	0	0	0
TOTALS FOR ALL SPECIES	1	1	0

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	MAY 6 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	MAY 6 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M	MAY 6 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	MAY 6 1981 MARMION LAKE -NORTH TRAP NET 1.2 M	MAY 6 1981 MARMION LAKE -SOUTH TRAP NET 1.2 M	MAY 7 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	MAY 7 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M
NORTHERN PIKE	1	0	0	0	0	7	0
WHITE SUCKER	5	0	0	0	0	1	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	1	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	6	0	1	0	0	8	0

	MAY 7 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	MAY 7 1981 MARMION LAKE -NORTH TRAP NET 1.2 M	MAY 7 1981 MARMION LAKE -SOUTH TRAP NET 1.2 M	MAY 8 1981 ABIE LAKE TRAP NET 1.2 M	MAY 8 1981 ICY LAKE TRAP NET 1.2 M	MAY 8 1981 SNOW LAKE TRAP NET 1.2 M	MAY 9 1981 ABIE LAKE TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	0	0	0	5
WHITE SUCKER	0	1	0	10	0	0	5
BURBOT	1	1	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	1	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	1	0	0	4
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	2	0	28	0	0	14

	MAY 9 1981 FOTHERINGHAM LAKE TRAP NET 1.2 M	MAY 9 1981 ICY LAKE TRAP NET 1.2 M	MAY 9 1981 SNOW LAKE TRAP NET 1.2 M	MAY 19 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	MAY 19 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M	MAY 19 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	MAY 19 1981 MARMION LAKE -NORTH TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	2	0	0	0
WHITE SUCKER	0	0	0	5	4	0	0
BURBOT	0	0	1	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	1	0
YELLOW PICKEREL(WALLEYE	0	0	0	3	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	0	1	10	4	1	0

	MAY 20 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	MAY 20 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M	MAY 20 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	MAY 20 1981 MARMION LAKE -NORTH TRAP NET 1.2 M	MAY 21 1981 FOTHERINGHAM LAKE TRAP NET 1.2 M	MAY 21 1981 MARMION LAKE -SOUTH TRAP NET 1.2 M	MAY 22 1981 FOTHERINGHAM LAKE TRAP NET 1.2 M
NORTHERN PIKE	2	0	0	0	3	0	3
WHITE SUCKER	9	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	2	0	1	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	11	0	1	0	3	0	3

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	MAY 22 1981 ICY LAKE	JUNE 2 1981 ABIE LAKE	JUNE 2 1981 FOTHERINGHAM LAKE	JUNE 2 1981 ICY LAKE	JUNE 2 1981 MARMION LAKE -SOUTH	JUNE 2 1981 SNOW LAKE	JUNE 3 1981 ABIE LAKE
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	3	4	1	1	0	0
WHITE SUCKER	0	0	0	7	0	2	0
BURBOT	0	0	1	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	2	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	5	5	8	1	2	0

	JUNE 3 1981 FOTHERINGHAM LAKE	JUNE 3 1981 ICY LAKE	JUNE 3 1981 MARMION LAKE -SOUTH	JUNE 3 1981 SNOW LAKE	JUNE 4 1981 MARMION LAKE -ANDERSON DAM	JUNE 4 1981 MARMION LAKE -LOWER SEINE BAY	JUNE 4 1981 MARMION LAKE -CENTRAL
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	2	2	0	1	0	0	1
WHITE SUCKER	2	2	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	1	3	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	1	1	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	4	4	0	2	4	1	1

	JUNE 4 1981 MARMION LAKE -NORTH	JUNE 5 1981 MARMION LAKE -ANDERSON DAM	JUNE 5 1981 MARMION LAKE -LOWER SEINE BAY	JUNE 5 1981 MARMION LAKE -CENTRAL	JUNE 5 1981 MARMION LAKE -NORTH	JUNE 16 1981 ABIE LAKE	JUNE 16 1981 FOTHERINGHAM LAKE
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	1	0	0	0	1	0
WHITE SUCKER	0	0	0	0	0	2	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	1	0	0	0	3	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	2	0	0	0	6	0

	JUNE 16 1981 ICY LAKE	JUNE 16 1981 MOOSE LAKE	JUNE 16 1981 SNOW LAKE	JUNE 17 1981 ABIE LAKE	JUNE 17 1981 FOTHERINGHAM LAKE	JUNE 17 1981 ICY LAKE	JUNE 17 1981 MOOSE LAKE
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	1	0	0	0
WHITE SUCKER	6	0	0	1	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	2	0	0	1	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	8	0	0	3	0	0	0

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	JUNE 17 1981 SNOW LAKE TRAP NET 1.2 M	JUNE 18 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JUNE 18 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	JUNE 18 1981 MARMION LAKE -NORTH TRAP NET 1.2 M	JUNE 19 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JUNE 19 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M	JUNE 19 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M
NORTHERN PIKE	0	1	0	0	0	0	0
WHITE SUCKER	0	1	0	2	1	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	1	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	1	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	2	0	3	1	0	0

	JUNE 19 1981 MARMION LAKE -NORTH TRAP NET 1.2 M	JUNE 19 1981 MARMION LAKE -SOUTH TRAP NET 1.2 M	JULY 9 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JULY 10 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JULY 14 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JULY 15 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JULY 16 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M
NORTHERN PIKE	0	0	1	0	0	0	0
WHITE SUCKER	0	0	0	0	2	2	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	3	2	2	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	4	1	1
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	0	4	2	8	3	1

	JULY 17 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JULY 21 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JULY 21 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	JULY 21 1981 MARMION LAKE -NORTH TRAP NET 1.2 M	JULY 22 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	JULY 22 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	JULY 22 1981 MARMION LAKE -NORTH TRAP NET 1.2 M
NORTHERN PIKE	1	2	1	1	1	0	0
WHITE SUCKER	1	1	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	1	1	1	1	2	0	0
YELLOW PICKEREL(WALLEYE	0	0	1	4	2	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	3	4	3	6	5	0	0

	JULY 23 1981 ABIE LAKE TRAP NET 1.2 M	JULY 23 1981 ICY LAKE TRAP NET 1.2 M	JULY 23 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M	JULY 23 1981 MARMION LAKE -SOUTH TRAP NET 1.2 M	JULY 24 1981 ABIE LAKE TRAP NET 1.2 M	JULY 24 1981 ICY LAKE TRAP NET 1.2 M	JULY 24 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M
NORTHERN PIKE	1	4	0	0	0	2	0
WHITE SUCKER	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	3	5	0	1	0
YELLOW PICKEREL(WALLEYE	0	1	6	0	1	1	1
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	5	9	5	1	4	1

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	JULY 24 1981 MARMION LAKE -SOUTH	JULY 28 1981 MOOSE LAKE	JULY 28 1981 SNOW LAKE	JULY 29 1981 MOOSE LAKE	JULY 29 1981 SNOW LAKE	JULY 29 1981 SLUSH LAKE	AUG. 18 1981 MARMION LAKE -ANDERSON DAM
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	2	1	0	0	0	0
WHITE SUCKER	0	0	0	3	0	1	0
BURBOT	0	0	0	0	0	1	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	3	0	4	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	5	1	7	0	2	0

	AUG. 18 1981 MARMION LAKE -LOWER SEINE BAY	AUG. 18 1981 MARMION LAKE -CENTRAL	AUG. 18 1981 MARMION LAKE -NORTH	AUG. 18 1981 MARMION LAKE -SOUTH	AUG. 19 1981 MARMION LAKE -ANDERSON DAM	AUG. 19 1981 MARMION LAKE -LOWER SEINE BAY	AUG. 19 1981 MARMION LAKE -CENTRAL
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	0	1	0	0
WHITE SUCKER	0	2	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	1	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	1	0	0	0	0	1
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	4	0	0	1	0	1

	AUG. 19 1981 MARMION LAKE -NORTH	AUG. 19 1981 MARMION LAKE -SOUTH	AUG. 20 1981 ABIE LAKE	AUG. 20 1981 ICY LAKE	AUG. 20 1981 MOOSE LAKE	AUG. 20 1981 SNOW LAKE	AUG. 20 1981 SLUSH LAKE
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	1	0	2	0	0	0	0
WHITE SUCKER	0	0	0	1	2	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	1	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	1	0	1	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	1	3	1	3	0	0

	AUG. 21 1981 ABIE LAKE	AUG. 21 1981 ICY LAKE	AUG. 21 1981 MOOSE LAKE	AUG. 21 1981 SNOW LAKE	AUG. 21 1981 SLUSH LAKE	SEPT 15 1981 MARMION LAKE -ANDERSON DAM	SEPT 15 1981 MARMION LAKE -LOWER SEINE BAY
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	1	0	0	0	1	1	1
WHITE SUCKER	0	0	0	0	0	1	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	2	0	0	0	0	0	2
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	3	0	0	0	1	2	3

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	SEPT 15 1981 MARMION LAKE -CENTRAL	SEPT 15 1981 MARMION LAKE -NORTH	SEPT 15 1981 SLUSH LAKE	SEPT 16 1981 MARMION LAKE -ANDERSON DAM	SEPT 16 1981 MARMION LAKE -LOWER SEINE BAY	SEPT 16 1981 MARMION LAKE -CENTRAL	SEPT 16 1981 MARMION LAKE -NORTH
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	2	0	0	0
WHITE SUCKER	0	0	2	0	0	1	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	1	0	0	0
YELLOW PERCH	0	0	0	1	1	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	1	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	0	2	5	1	1	0

	SEPT 16 1981 SLUSH LAKE	SEPT 17 1981 ABIE LAKE	SEPT 17 1981 ICY LAKE	SEPT 17 1981 MOOSE LAKE	SEPT 17 1981 MARMION LAKE -SOUTH	SEPT 17 1981 SNOW LAKE	SEPT 18 1981 ABIE LAKE
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	3	2	0	0	0	1
WHITE SUCKER	2	1	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	1	0	1	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	2	4	2	1	0	1	1

	SEPT 18 1981 ICY LAKE	SEPT 18 1981 MOOSE LAKE	SEPT 18 1981 MARMION LAKE -SOUTH	SEPT 18 1981 SNOW LAKE	SEPT 22 1981 MARMION LAKE -ANDERSON DAM	SEPT 29 1981 MARMION LAKE -ANDERSON DAM	SEPT 29 1981 MARMION LAKE -LOWER SEINE BAY
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	0	2	0	0
WHITE SUCKER	2	2	0	0	2	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	1	0	0	0
YELLOW PERCH	0	1	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	1	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	2	3	0	1	4	1	0

	SEPT 29 1981 MARMION LAKE -CENTRAL	SEPT 29 1981 MARMION LAKE -NORTH	SEPT 29 1981 MARMION LAKE -SOUTH	SEPT 30 1981 MARMION LAKE -ANDERSON DAM	SEPT 30 1981 MARMION LAKE -LOWER SEINE BAY	SEPT 30 1981 MARMION LAKE -CENTRAL	SEPT 30 1981 MARMION LAKE -NORTH
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	2	0	0	1	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	2	0
YELLOW PICKEREL(WALLEYE	2	0	0	1	0	2	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	4	0	0	2	0	4	0

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	SEPT 30 1981 MARMION LAKE -SOUTH	OCT. 1 1981 ABIE LAKE	OCT. 1 1981 ICY LAKE	OCT. 1 1981 SNOW LAKE	OCT. 1 1981 SLUSH LAKE	OCT. 2 1981 ABIE LAKE	OCT. 2 1981 ICY LAKE
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	0	0	1	0
WHITE SUCKER	0	0	4	3	0	0	0
BURBOT	0	0	0	2	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	0	4	5	0	1	0

	OCT. 2 1981 SNOW LAKE	OCT. 13 1981 ABIE LAKE	OCT. 13 1981 ICY LAKE	OCT. 13 1981 MOOSE LAKE	OCT. 13 1981 SNOW LAKE	OCT. 13 1981 SLUSH LAKE	OCT. 14 1981 ABIE LAKE
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	0	1	0	0	0	1
WHITE SUCKER	2	0	0	0	0	0	0
BURBOT	1	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	3	0	1	0	0	0	1

	OCT. 14 1981 ICY LAKE	OCT. 14 1981 MOOSE LAKE	OCT. 14 1981 SNOW LAKE	OCT. 14 1981 SLUSH LAKE	OCT. 15 1981 MARMION LAKE -ANDERSON DAM	OCT. 15 1981 MARMION LAKE -LOWER SEINE BAY	OCT. 15 1981 MARMION LAKE -CENTRAL
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	2	0	0	0	1	0	1
WHITE SUCKER	0	0	1	0	1	0	1
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	2	0	1	0	2	0	2

	OCT. 15 1981 MARMION LAKE -NORTH	OCT. 15 1981 MARMION LAKE -SOUTH	OCT. 16 1981 MARMION LAKE -ANDERSON DAM	OCT. 16 1981 MARMION LAKE -LOWER SEINE BAY	OCT. 16 1981 MARMION LAKE -CENTRAL	OCT. 16 1981 MARMION LAKE -NORTH	OCT. 16 1981 MARMION LAKE -SOUTH
	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M	TRAP NET 1.2 M
NORTHERN PIKE	0	0	0	0	0	1	0
WHITE SUCKER	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	0	0	0	0	1	0

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	OCT. 20 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.8 M	OCT. 23 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.8 M	OCT. 27 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	OCT. 27 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M	OCT. 27 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.8 M	OCT. 27 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	OCT. 27 1981 MARMION LAKE -NORTH TRAP NET 1.2 M
NORTHERN PIKE	1	1	0	0	0	1	0
WHITE SUCKER	1	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	2	1	0	0	0	1	0

	OCT. 27 1981 MARMION LAKE -SOUTH TRAP NET 1.2 M	OCT. 28 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.2 M	OCT. 28 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.2 M	OCT. 28 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.8 M	OCT. 28 1981 MARMION LAKE -CENTRAL TRAP NET 1.2 M	OCT. 28 1981 MARMION LAKE -NORTH TRAP NET 1.2 M	OCT. 29 1981 ABIE LAKE TRAP NET 1.2 M
NORTHERN PIKE	1	1	0	0	0	0	2
WHITE SUCKER	0	0	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	1	1	0	0	0	0	2

	OCT. 29 1981 ICY LAKE TRAP NET 1.2 M	OCT. 29 1981 MOOSE LAKE TRAP NET 1.2 M	OCT. 29 1981 MARMION LAKE -SOUTH TRAP NET 1.8 M	OCT. 29 1981 SLUSH LAKE TRAP NET 1.2 M	OCT. 30 1981 ABIE LAKE TRAP NET 1.2 M	OCT. 30 1981 ICY LAKE TRAP NET 1.2 M	OCT. 30 1981 MOOSE LAKE TRAP NET 1.2 M
NORTHERN PIKE	0	1	0	1	1	0	0
WHITE SUCKER	0	0	0	0	0	0	1
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	1	0	1	1	0	1

	OCT. 30 1981 MARMION LAKE -SOUTH TRAP NET 1.5 M	OCT. 30 1981 SNOW LAKE TRAP NET 1.2 M	OCT. 30 1981 SLUSH LAKE TRAP NET 1.2 M	NOV. 3 1981 ABIE LAKE TRAP NET 1.8 M	NOV. 4 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.8 M	NOV. 5 1981 MARMION LAKE -CENTRAL TRAP NET 1.8 M	NOV. 6 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.8 M
NORTHERN PIKE	0	0	0	0	1	0	1
WHITE SUCKER	0	1	0	0	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	1	0	1
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	1	0	0	2	0	2

APPENDIX LISTING OF FISH CATCH

ATIKOKAN JAN. 1 1981 TO DEC. 31 1982

NET NAMES: 1.2M TRAP NETS TO 1.8M TRAP NETS

	NOV. 6 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.8 M	NOV. 6 1981 MARMION LAKE -CENTRAL TRAP NET 1.8 M	NOV. 6 1981 MARMION LAKE, LONE PINE TRAP NET 1.8 M	NOV. 6 1981 MARMION LAKE -NORTH TRAP NET 1.8 M	NOV. 6 1981 MARMION LAKE -SOUTH TRAP NET 1.8 M	NOV. 7 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.8 M	NOV. 7 1981 MARMION LAKE -CENTRAL TRAP NET 1.8 M
NORTHERN PIKE	1	0	0	1	0	1	0
WHITE SUCKER	0	0	0	0	0	0	0
BURBOT	1	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	1	0	0
TOTALS FOR ALL SPECIES	2	0	0	1	1	1	0

	NOV. 7 1981 MARMION LAKE, LONE PINE TRAP NET 1.8 M	NOV. 7 1981 MARMION LAKE -NORTH TRAP NET 1.8 M	NOV. 7 1981 MARMION LAKE -SOUTH TRAP NET 1.8 M	NOV. 9 1981 MARMION LAKE -ANDERSON DAM TRAP NET 1.8 M	NOV. 9 1981 MARMION LAKE -LOWER SEINE BAY TRAP NET 1.8 M	NOV. 9 1981 MARMION LAKE -CENTRAL TRAP NET 1.8 M	NOV. 9 1981 MARMION LAKE, LONE PINE TRAP NET 1.8 M
NORTHERN PIKE	0	0	0	0	5	0	0
WHITE SUCKER	0	0	0	1	0	0	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	0	0	1	5	0	0

	NOV. 9 1981 MARMION LAKE -NORTH TRAP NET 1.8 M	NOV. 9 1981 MARMION LAKE -SOUTH TRAP NET 1.8 M	NOV. 10 1981 ICY LAKE TRAP NET 1.8 M	NOV. 10 1981 MOOSE LAKE TRAP NET 1.8 M	NOV. 10 1981 SNOW LAKE TRAP NET 1.8 M	NOV. 10 1981 SLUSH LAKE TRAP NET 1.8 M	NOV. 11 1981 ICY LAKE TRAP NET 1.8 M
NORTHERN PIKE	0	1	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	1	0
BURBOT	0	0	0	0	0	0	0
PUMPKINSEED	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0	0	0	0	0
LAKE WHITEFISH	0	0	0	0	0	0	0
CISCO	0	0	0	0	0	0	0
TOTALS FOR ALL SPECIES	0	1	0	0	0	1	0

	NOV. 11 1981 MOOSE LAKE TRAP NET 1.8 M	NOV. 11 1981 SNOW LAKE TRAP NET 1.8 M	NOV. 11 1981 SLUSH LAKE TRAP NET 1.8 M
NORTHERN PIKE	0	0	1
WHITE SUCKER	0	0	0
BURBOT	0	0	0
PUMPKINSEED	0	0	0
YELLOW PERCH	0	0	0
YELLOW PICKEREL(WALLEYE	0	0	0
LAKE WHITEFISH	0	0	0
CISCO	0	0	0
TOTALS FOR ALL SPECIES	0	0	1

APPENDIX II

TEMPERATURE PROFILES, ATIKOKAN ACOUSTIC FISH CENSUS, AUGUST 1981

MARMION LAKE - LOCATION 6 - AUG 12

Depth (m)	STATION 1	2	3	4	5
Surface	22.0	21.8	21.8	21.8	21.8
1	21.5	21.5	21.8	21.8	21.8
2	21.5	21.6	21.7	21.8	21.7
3	21.2	21.5	21.7	21.8	21.7
4	21.2	21.5	21.5	21.6	21.6
5	21.2	21.0	21.2	21.2	21.3
6	18.0	17.2	17.7	16.2	15.8
7	14.5	14.2	14.2	14.3	14.5
8	13.5	13.2	13.5	13.5	14.1
9	13.0	12.5	12.8	12.8	-
10	12.5	12.0	12.2	12.2	-
11	11.5	11.5	11.5	11.4	-
12	11.5	10.5	10.5	10.3	-
13	10.5	9.8	9.5	9.8	-
14	8.9	8.5	8.8	8.5	-
15	8.0	7.7	8.0	8.0	-
16	8.0	7.4	7.4	7.4	-
17	-	7.2	7.2	7.1	-
18	-	7.0	7.0	7.0	-
19	-	7.0	6.8	7.0	-
20	-	7.0	6.8	7.1	-

LOWER SEINE LAKE - LOCATION 5 - AUG 13

Depth (m)	STATION 1	2	3	4	5
Surface	22.0	21.8	21.9	21.[illegible]	22.0
1	21.8	21.8	21.8	21.5	21.8
2	21.8	21.8	21.6	21.5	21.5
3	21.8	21.8	21.5	21.5	21.3
4	21.5	21.2	21.2	21.2	20.8
5	21.0	21.2	20.5	20.5	19.0
6	18.5	19.0	18.5	18.5	14.0
7	15.2	15.0	15.0	15.2	13.0
8	15.5	12.2	12.5	12.2	12.5
9	-	10.5	11.0	11.0	-
10	-	9.5	9.2	9.5	-
11	-	8.5	8.8	9.0	-
12	-	8.0	8.0	8.2	-
13	-	7.8	8.0	7.7	-
14	-	7.5	7.5	7.5	-
15	-	7.5	7.5	7.4	-
16	-	7.2	7.2	7.2	-
17	-	7.1	7.1	7.0	-
18	-	7.1	7.1	-	-
19	-	-	7.1	-	-

MARMION LAKE - LOCATION 7 - AUG 11

Depth (m)	STATION 1	2	3	4	5
Surface	22.0	22.0	21.8	21.7	21.[illegible]
1	22.0	22.0	21.8	21.5	21.5
2	22.0	21.8	21.8	21.9	21.8
3	21.7	21.8	21.8	21.8	21.2
4	21.5	21.7	21.6	21.8	21.8
5	21.2	21.4	21.5	21.6	21.8
6	20.2	20.5	20.5	21.5	21.5
7	16.5	19.0	19.1	17.2	16.8
8	14.5	14.8	14.5	15.2	14.0
9	13.5	13.5	13.7	13.6	13.2
10	13.2	13.0	13.2	13.2	13.5
11	-	12.2	12.0	12.5	-
12	-	-	11.5	12.0	-
13	-	-	11.2	11.2	-
14	-	-	10.8	10.8	-

ICY LAKE - LOCATION 3 - AUG 15

Depth (m)	STATION 1	2	3	4	5
Surface	21.0	21.0	21.0	21.0	21.0
1	21.0	21.0	21.0	21.0	21.0
2	21.0	21.0	21.0	21.0	21.0
3	21.0	21.0	21.0	21.0	21.0
4	21.0	21.0	21.0	21.0	21.0
5	-	19.0	19.0	20.0	18.5
6	-	15.0	15.0	15.5	15.5
7	-	12.0	12.0	12.0	15.0
8	-	9.0	9.0	9.5	11.5
9	-	8.5	7.5	7.5	9.0
10	-	-	6.5	7.5	8.0
11	-	-	6.0	6.0	-

ABIE LAKE - LOCATION 4 - AUG 13

Depth (m)	STATION 1	2	3	4	5
Surface	22.8	22.5	22.5	22.5	22.5
1	22.7	22.5	22.2	22.5	22.8
2	22.5	22.5	22.2	22.0	22.5
3	22.2	21.2	22.0	22.0	21.2
4	21.5	17.2	21.5	21.2	17.8
5	17.2	12.7	16.0	15.5	12.2
6	13.2	10.5	12.8	12.0	11.8
7	12.8	9.2	11.2	11.0	-
8	-	8.2	9.0	9.5	-
9	-	-	8.8	-	-
10	-	-	8.5	-	-

APPENDIX 12

MIDWATER GILL NET CATCHES ASSOCIATED WITH ACOUSTIC FISH CENSUS
AUGUST 1981

Species	Location and Date				
	6-Marmion Lake Deep Basin Aug 26	7-Marmion Lake Shallow Basin Aug 27	5-Lower Seine Lake Aug 25	4-Abie Lake Aug 27	3-Icy Lake Sept 3
Lake Whitefish	10 (10; 44 cm; 28-54 cm)*	1 (1; 37 cm)	24 (24; 42 cm, 26-52 cm)	3 (2, 44-52 cm	No Fish Caught
Cisco	23 (1, 41 cm)	1	23	17	
Walleye	2 (2; 53-62 cm)	2 (2; 46-56 cm)		3 (3; 52 cm; 35-65 cm)	
Northern Pike		1 (1: 82 cm)		1 (1; 70 cm)	
White Sucker				8	
Burbot	1		1	1	
Total	36	5	48	31	0